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Program to Calculate Size Specific Particulate Emissions for Mobile Sources A User's Guide

Energy and Environmental Analysis, Inc.
Arlington, VA

Prepared for

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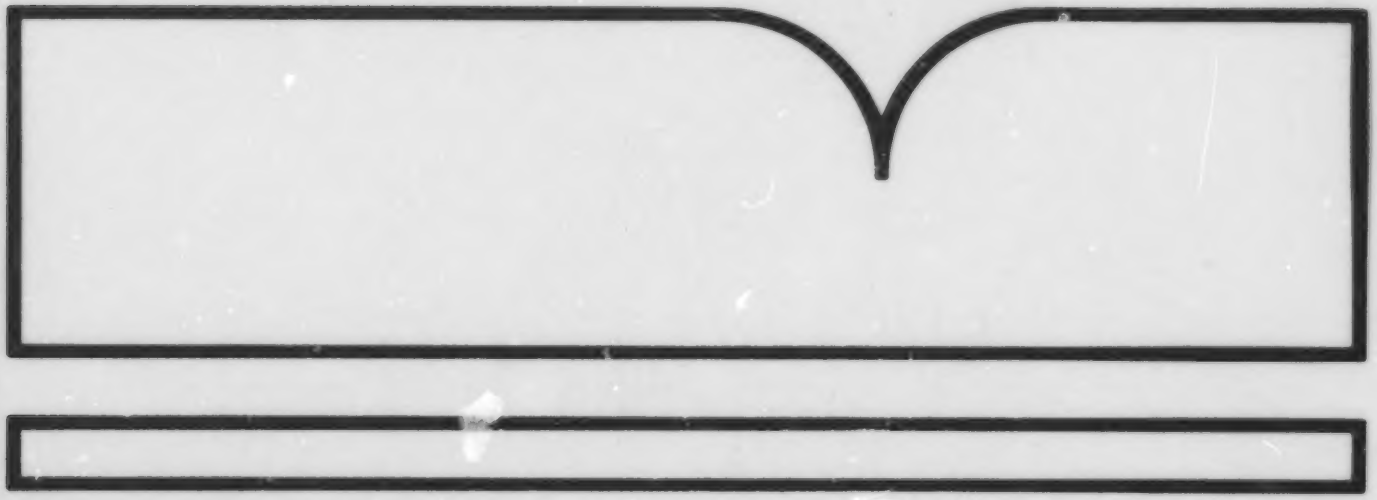

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A Program to Calculate Size Specific Particulate Emissions for Mobile Sources — A User's Guide

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This report provides documentation for a computer program which calculates the size specific particulate emissions from mobile sources in a given geographic area. The documentation includes detailed explanations of inputs and outputs, program structure, and default data. The report includes copies of the source code, data file, and some sample runs.

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A Program to Calculate Size Specific Particulate Emissions for Mobile Sources — A User's Guide

by

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I. INTRODUCTION

This report is provided as documentation to a program which calculates the total areawide lead and particulate emissions from gasoline and diesel fueled on-road vehicles, trucks and motorcycles for particle sizes up to 10 microns. The program provides a large amount of default (normal) data and also many options to tailor the conditions to each locality. The period of interest spans 1980 to 1995. (Years later than 1995 can be calculated but there is no data specific to years later than 1995).

The methodology and sources of data for this program are described in detail in the report Size Specific Total Particulate Emission Factors for Mobile Sources prepared August 1984, for EPA by EEA. That report describes the calculation of particulate emission factors for each of the six vehicle classes used in this program. The vehicle classes are: 1) light duty vehicles, 2) light duty trucks 6000 pounds or less, 3) light duty trucks more than 6000 pounds, 4) heavy duty gasoline trucks, 5) heavy duty diesel trucks, and 6) motorcycles. It also provides the emission factors for each major type of particulate (lead, organic, sulfate, and diesel composite). A brief summary of the methods used for the calculation is given in Section 2.

The program inputs and format are designed to parallel those found in MOBILE 3. The normal user inputs include the scenario year, the vehicle speed, the driving conditions and the particle size cutoff (i.e., the largest particle size to be included in the total emissions). By setting control flags, the user can elect to replace the default data used in calculations with locality specific data. These include tampering rates for catalyst equipped light duty vehicles and trucks, misfueling rates, the VMT mix, mileage accumulation rates, registration fraction by age, the lead content of gasoline and the implementation of an I/M program. A description of each input is given in Section 3.

The output report gives a breakdown of particulate emission factors type for each vehicle class as well as totals and fractions of the total that each

particulate contributes. The output report and any error and diagnostic messages that are generated are described in Section 4.

The program structure is described in Section 5. A dictionary of subroutines and common blocks of interest to programmers wishing to make changes to the program is included. Users may skip this section.

Section 6 provides example runs of the program with various options. Use of the program in both batch and interactive modes are shown.

The appendices include a source code listing and a listing of the data file containing the default data.

2. OVERVIEW OF METHODOLOGY

Particulate emissions consists of lead, organic and sulfate emissions. Different types of vehicles emit varying amounts of each particulate type depending upon fuel type, emission control technology and operating mode. Lead particulates consist mainly of lead salts rather than lead alone. Organic emissions include elemental carbon and soluble organics. Particulate emissions from diesel vehicles are a composite particulate having elements of the three other types but consisting largely of organic emissions.

The calculations seek to model the particulate emissions from all types of on-road vehicles. The procedure is to calculate the emissions factor for each type of particulate from each vehicle class and then sum over all vehicle classes to get the total emission factor in grams per mile traveled. For any given year the procedure may be expressed mathematically

$$EF_{pm,n,s} = \sum_{i=1}^{6} t_{i,n} EF_{i,n,s} + EF_{brakes}(M_B) + EF_{tires}$$

where $EF_{pm,n,s}$ = size specific all-vehicle class total particulate emission factor on January 1 of calendar year n at vehicle speed s (g/mile)

i = vehicle class designator; 1=light-duty vehicles (LDV), 2=light-duty trucks I (LDTI), 3=light-duty trucks II (LDT2), 4=heavy-duty gas vehicles (HDGV), 5-heavy-duty diesel vehicles (HDDV), 6=motorcycles (MC)

s = vehicle speed; avg. Federal Test Procedure (FTP) = 19.6, avg. Sulfate Emissions Test (SET) = 34.8 (miles/hr); (Note: The FTP and SET are driving cycles used for the determination of emission factors.)

$t_{i,n}$ = area travel fraction of vehicle class i in calendar year n

$EF_{i,n,s}$ = particulate emission factor for vehicle class i in calendar year n at vehicle speed s (g/mile)

EF_{brakes} = airborne brake wear particulate emission factor component = 0.002 grams/mile; this emission factor

component is assumed to be the same for all vehicle classes, vehicle speeds and calendar years (all i,s, and n) due to lack of separate information for each i,s, and n

EF_{tires} = airborne tire wear particulate emission factor component = 0.002 grams/mile; this emission factor component is assumed to be the same for all vehicle classes, vehicle speeds and calendar years (all i,s, and n) due to lack of separate information for each i,s, and n

M_B = fraction of airborne particles less than a user-specified size cutoff (0.1=10 m) that are attributable to vehicle brake wear, from Table 2-20 or Figure 2-4

Calculating the emissions factor for each vehicle class requires knowledge of emissions factors and numbers of each type of vehicle within the class. For instance, light-duty vehicles includes leaded, unleaded and diesel vehicles each with different emission characteristics.

The emissions factors required are given in the report Size Specific Total Particulate Emission Factors of Mobile Sources prepared for EPA by EEA. The emissions factors are functions of vehicle class, model year, fuel type, catalyst type (for sulfates), vehicle speed (for lead and sulfates), misfueling and catalyst tampering rates (for unleaded vehicles). Changes in emissions factors from model year differences occur because of changes in fuel economy, emission control technology and the shift from leaded to unleaded gasoline.

Each vehicle class is modeled as a fleet of vehicles including vehicles up to 20 years old. The fraction of vehicles by age within each class favors newer vehicles since older vehicles wear out and are taken out of service. Newer vehicles also have higher mileage accumulation rates than older vehicles. Misfueling rates increase with age since there is more opportunity to misfuel the vehicle over a long period of time. For each vehicle class the registration fraction, mileage accumulation rate and misfueling rate are assumed to vary year by year up to 20 years of age. Vehicles 20 years old and older are modeled as a single age.

For a given scenario year, the total emission factor from a vehicle class is a sum of the emissions factors over the previous 20 model years weighted by the fleet fraction of vehicle class. The total emission factor from all

vehicle classes are further weighted by the areawide travel fraction (i.e. the ratio of vehicle miles traveled by a vehicle class to the total traveled by all vehicle classes in the area).

The final results of the calculation are given in grams per mile traveled. The total emissions can be calculated by multiplying the composite emission factor by the total number of miles traveled by all classes of vehicles.

3. INPUTS

Inputs to the program allow the user to specify and change the scenario conditions to fit the locality being modeled. Like MOBILE 3, the various input options and scenario options are set by using control flags. The sections of user provided data are divided into a control section, one time data section and parameter section just like MOBILE 3. Section 3.1 describes the control section, Section 3.2 describes the one time data section and Section 3.3 describes the parameter section.

3.1 THE CONTROL SECTION

The control section contains the control flags necessary to select the various options available to the user. All of the flags must be present and have valid values for the program to run. Inputting "1" for each flag will result in the program using the default values and options built into the program. Table 3-1 summarizes the control flags.

3.1.2 The Flags

3.1.2.1 IPROMT

This flag works exactly as it does in MOBILE 3. It is used to select whether prompts are required and whether horizontal or vertical format is used for further flag inputs. Horizontal format has all the control flags in a single record. Vertical format has each flag in a separate record. No prompt is issued for this input since its purpose is to determine if prompts are required. (Format = I1). The options are:

1 - No prompting; use vertical format
2 - Program prompts; use vertical format
3 - No prompting; use horizontal format
4 - Program prompts; use horizontal format

TABLE 3-1

FLAGS CONTROLLING INPUT AND EXECUTION

Record Number	Variable	Description	FMT	Value	Action
1	IPROMT	Flag for prompting of input	I1,3A1	1XYZ	No prompts vertical format
	IOUNEW	Values for output units 1) X=report 2) Y=diagnostic error reports 3) Z=prompt messages (Default for these units is 6)		2XYZ	prompt vertical format
				3XYZ	no prompts horizontal format
				4XYZ	prompts horizontal format
2	PROJID	80 character title used as output header	20A4		
3	TAMFLG	Flag for optional input of tampering rates	I1		1=normal 2=user data in one-time section
4	VMFLAG	Selects optional user supplied VMT mix among vehicle types	I1		1=MOBILE 3 VMT mix 2=user VMT mix for each scenario in parameter section 3=user VMT mix for all scenarios in one-time section

Record Number	Variable	Description	FMT	Value	Action
5	MYMRFG	Selects optional mileage accumulation and registration versus age	I1		1=normal 2=user supplied mileage accumulation rates in one-time section 3=user supplied registration in one-time section 4=user supplied mileage accumulation and registration rates in one-time section
6	MISFLG	Flag for optional input of misfueling rates	I1		1=normal 2=user data for LDV, LDT1, LDT2 in one-time section 3=use "simple" rates
7	SPCFLG	Selects optional lead content in leaded and unlead gasoline	I1		1=normal MOBILE 3 lead content 2=user supplied lead content
8	IMFLAG	Indicates I/M program	I1		1=no I/M 2=I/M

IOUNEW

This variable allows the user to change the output units for the results, messages and prompts. The default value for all of these is 6. IOUNEW must be part of the same record as IPROMT and immediately follows it.

Value = XYZ Format = 3A1

Options:

X = Results unit

Y = Diagnostic messages

Z = Prompting messages

3.1.2.2 PROJID

This is an 80 character title to be used as a header.

3.1.2.3 TAMFLG

This flag allows the user to input alternate catalyst tampering rates if desired for light duty vehicles and trucks. If user supplied tampering rates are selected, the user needs to specify tampering rates only for the case selected by IMFLAG (i.e., I/M program or no I/M program).

Options: 1 - normal tampering rates

2 - user supplied tampering rates in one-time section (3 values)

3.1.2.4 VMFLAG

This flag selects the areawide vehicle miles traveled fraction. The default fractions come from MOBILE 3. User supplied fractions should have one value for each vehicle class.

Options: 1 - use MOBILE 3 VMT mix

2 - user supplied VMT mix for each scenario

3 - user supplied VMT mix for all scenarios in this run (one-time data)

3.1.2.5 MYMRFG

This flag selects the mileage accumulation rate and registration versus age. The rates and registration fractions cover ages up to 20 years and are

specified for each vehicle class. User supplied data can be used to replace the default data for any or all vehicle classes.

Options: 1 - normal mileage accumulation rates and registration fraction
2 - user supplied mileage accumulation rates (one time data)
3 - user supplied registration fraction (one time data)
4 - user supplied mileage accumulation rates and registration fractions (one time data)

3.1.2.6 MISFLG

This flag selects the misfueling rates desired. The program normally uses a set of misfueling rates that varies according to vehicle class and age. The user supplied rates are generated for each vehicle class from a slope and intercept with mileage as the dependent variable.

The simple rates are a set of misfueling rates that have been averaged over vehicle age; hence, only the vehicle class matters.

Options: 1 - normal misfueling rates
2 - user supplied slope and zero mile intercept
3 - "simple" misfueling rates, vehicle class dependent only

3.1.2.7 SPCFLAG

This flag selects normal or user supplied lead content of leaded and unleaded gasoline. The lead content can be changed for any number of years with the default lead content used for those years previous to the changes.

Options: 1 - normal MOBILE 3 lead content
2 - user supplied lead content of gasoline

3.1.2.8 IMFLAG

This flag indicates whether an inspection maintenance program is in effect in the area.

Options: 1 - no I/M program
2 - I/M program in effect

3.2 ONE TIME DATA SECTION

This section contains data only if the flags in the control section have been set to expect user supplied data here. This data is input only once and is used for all scenarios of the run. The data in this section concerns locality dependent variables.

The one time data section is included only in the following cases in the order listed.

1) The user wishes to input local catalyst tampering rates (TAMFLG = 2)
2) The user wishes to use an alternate VMT mix for all scenarios (VMFLAG = 3)
3) The user wishes alternate registration and/or mileage accumulation rates (MYMRFG = 2, 3 or 4)
4) The user wishes to input alternate misfueling rates (MISFLG = 2)
5) The user wishes alternate lead content in gasoline for a range of years (SPCFLG = 2)

The order of the data in this section is the same as the order of flags in the control section.

3.2.1 Alternate Catalyst Tampering Factors

The data to be entered are the tampering rates for LDV, LDTl and LDT2. This data should be appropriate for the IMFLAG chosen, i.e. if there is no I/M program in effect, enter the rates for no I/M program. The format is 3(F4.3,1X).

3.2.2 Alternate VMT Mix

The data to be entered is the areawide vehicle miles traveled fraction for each vehicle class. The sum of the fractions should equal one. If not, a warning message will be printed and the VMT fractions will be normalized. There is one record with format 6(F5.3,1X).

3.2.3 Alternate Registration and Mileage Accumulation

This section allows changes to the registration and mileage accumulation rates for any or all vehicle classes. Since LDV, LDTl and LDT2 include diesel vehicles with different registration and mileage accumulation rates,

the fuel type must also be specified when indicating which vehicle class the user wishes to change. For HDGV, HDDV and MC the fuel type that is input is ignored. The registration and mileage accumulation rates for leaded and unleaded vehicles are automatically set to be equal; when the user chooses leaded or unleaded as the fuel type, the registration and mileage accumulation for the type that was not chosen are set to the same value as the type chosen.

3.2.3.1 Alternate Registration

The data is entered in three records for each vehicle class. The first record has format (I1,1X,I1) where the data to be entered is the vehicle class (1-6) and fuel type (1 or 2 = gasoline, 3 = diesel). The second record contains the registration information for the first ten years of age in format (10 F5.3). The third record contains the registration information for years 11 to 20 years or more (11-20+) in format 10 F5.3.

There can be as many sets of three records as desired. After the last set, there should be a card with three zeroes ('000') to signal the end of registration information.

3.2.3.2 Alternate Mileage Accumulation Rate

The data is entered in three records for each vehicle class in the same fashion as the registration data. The first record has format (I1,1X,I1) where the data is be entered is the vehicle class (1-6) and fuel type (1 or 2 = gasoline, 3 = diesel). The second record contains the mileage accumulation rate for the first 10 years in format 10(I5,1X). The third record contains the mileage accumulation rate for the years 11 to 20 or more (11-20+) in format 10(I5,1X).

There can be as many sets of three records as desired. After the last set, there should be a card with three zeroes ('000') to signal the end of the mileage accumulation information.

3.2.4 Alternate Misfueling Rates

The data to be entered is the zero mile misfueling rate and the slope for the four vehicle classes LDV, LDT1, LDT2 and HDGV1. A negative slope or

intercept will produce an error message. There is one record for each class with format (F8.6,1X,F8.6).

3.2.5 Alternate Lead Content in Gasoline

The data entered replaces the default lead content information for future years. For years prior to the starting year, the default information is used. The first record gives the starting year for the user supplied data and the last year in format (I4,1X,I4). Subsequently, there is one record for each year giving the leaded and unleaded lead content in grams per gallon in format F5.3,1X,F5.3. The data on the last record is used for the last year and all later years.

3.3 PARAMETER SECTION

This section contains data that is changed for each scenario. There can be as many scenarios as required in a single run of the program. Each scenario consists of four records (five, if VMFLAG = 3). The first record has the year of the scenario in I4 format. The second record has the vehicle speed in F4.1 format. The third record specifies the driving conditions in I1 format where a '1' indicates transient or cyclic driving and a '2' indicates a steady cruise. The fourth record contains the particle size cutoff in mirons in F5.2 format. The particle size cutoff is the largest size of particle to be included in the calculations. None of the four records have default values; all of them must be correctly specified. If VMFLAG is equal to three there is a fifth record to each scenario giving the VMT mix. The format is described in Section 3.2.2.

3.4 SUMMARY OF USER INPUTS

The user inputs are summarized in Table 3-2.

3.5 PROGRAM DATA FILE

The default data file contains all of the data necessary to run the program under standard conditions except for scenario year, vehicle speed, driving conditions and particle size cutoff. The subroutine EMFIN and associated subroutines reads the file in its entirety. User supplied data which supplants the default data is read in afterwards from the one time data section or parameter section.

TABLE 3-2

INPUT RECORD SEQUENCE SUMMARY

Input Record Sequence		Section
1	IPROMT Flag	Control
1	PROJID	Control
1	TAMFLG+	Control
1	VMFLAG+	Control
1	MYMRFG+	Control
1	MISFLG+	Control
1	SPCFLG+	Control
1	IMFLAG+	Control
(1	Tampering record if TAMFLG=2)	One-time
(1	VMT mix record if VMFLAG=3)	One-time
(3/class	Alternate registration if MYMRFG=3 or 4)	One-time
(1	Alternate registration end card if MYMRFG=3 or 4)	One-time
(3/class	Alternate mileage accumulation if MYMRFG=2 or 4)	One-time
(1	Alternate mileage accumulation end card if MYMRFG=2 or 4)	One-time
(4	Misfueling records if MISFLG=2)	One-time
(1	Starting and ending years for lead content of gasoline if SPCFLG=2)	One-time
(-	Lead content of gasoline cards if SPCFLG=2)	One-time

1	Year of scenario	Parameter++
1	Vehicle Speed	Parameter
1	Driving conditions	Parameter
1	Particle size cutoff	Parameter
(1	VMT mix if VMFLAG=2)	Parameter

Notes +: May be on single record if horizontal format is chosen

++: Parameter section may be repeated as many times as desired

The default data file structure is shown in Table 3-3. If changes to the data file are made care should be taken to change the corresponding array dimensions in the program. The program comments include references to tables in the original report to aid making changes.

TABLE 3-3

DEFAULT DATA FILE SEQUENCE

1. LDV LDT1 LDT2 Organic Emission Factors
   a) no. of records - Format (I2)
   b) catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

2. LDV LDT1 LDT2 Sulfate Emission Factors
   a) no. of records - Format (I2)
   b) year, catalyst type, fuel type, vehicle speed, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F4.1, 1X, F5.3)
      see note 1

3. LDDV Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(I4, 1X, F5.3)
      see note 1

4. LDDT Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(i4, 1X, F5.3)
      see note 1

5. HDGV Organic Emission Factors
   a) no. of records - Format=(I2)
   b) year, catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

6. HDGV Sulfate Emission Factors
   a) no. of records - Format (I2)
   b) year, catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

7. HDDT Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(I4, 1X, F5.3)
      see note 1

8. LDV LDTI Lead Emission Factors
   a) no. of records - Format (I2)
   b) year, fuel type, emission factor - Format=(I4, IX, II, IX, F5.3)
      see note 1

9. LDT2 Lead Emission Factors
   a) no. of records - Format (I2)
   b) year, fuel type, emission factor - Format=(I4, IX, II, IX, F5.3)

10. Lead Content of Gasoline by Year
   a) no. of records - Format (I2)
   b) year, lead content of leaded, lead content of unleaded - Format=(I4, IX, II, IX, F5.3)
      see note 1

11. LDV Fraction of Fleet by Emission Control Type
    see note 2

12. LDV Fleet Sales Fractions by Fuel Type
    see note 3

13. LDV Travel Weighting (Registration and Mileage Accumulation Rates)
    see note 4

14. City/Highway Fuel Economy
   a) no. of records - Format (Iw)
   b) year, fuel economy for LDV, LDTI, LDT2, HDGVI, HDGV2, HDGV

15. Fuel Economy Speed Corrections
   a) no. of records - Format (I2)
   b) speed, transient driving speed correction, steady driving speed correction

16. LDTI Fraction of Fleet by Emission Control Type
    see note 2

17. LDTI Fleet Sales Fraction by Fuel Type
    see note 3

18. LDTI Travel Weighting (Registration and Mileage Accumulation Rates)
    see note 4

19. LDT2 Fraction of Fleet by Emission Control Type
    see note 2

20. LDT2 Fleet Sales Fraction by Fuel Type
    see note 3

21. LDT2 Travel Weighting (Registration and Mileage Accumulation Rate)
see note 4

22. LDDT Travel Weighting (Registration and Mileage Accumulation Rates)
see note 4

23. HDGV Fleet Sales Fraction by Fuel Type
see note 3

24. HDGV Travel Weighting (Registration and Mileage Accumulation Rates)
see note 4

25. HDDT Registration

a) no. of records - Format (I2)

b) registration fraction of total fleet by age (repeat)

26. MC Travel Weighting (Registration and Mileage Accumulation Rate)
see note 4

27. Simple Misfueling Rates
I/M program in effect, no I/M program
5 records for LDV, LDT1, LDT2, HDGV, MC
Format=(5X, F4.2, 1X, F4.2)

28. Misfueling by Age

a) no. of records - Format (I2)

b) each record contains misfueling rates for:

LDV with I/M
LDV w/o I/M
LDT1 with I/M
LDT1 w/o I/M
LDT2 with I/M
LDT2 w/o I/M
HDGV1 with I/M
HDGV1 w/o I/M

Format=3X, 8 F4.2

29. Particle Cumulative Fraction by Size

a) Particle Sizes

b) particle cumulative fractions

report a) and b) for leaded, unleaded
with catalyst, unleaded w/o catalyst,
diesel, brakes
Format - 5(F5.2, 1X)

30. Low Altitude HDDV Conversion Factors

a) no. of records

b) model year, conversion factor report as specified in 30a)

31. Fraction of Lead Exhausted
non-misfueled, 1975-1980 misfueled
1981+ misfueled vehicles
Format = 3(F4.2, 1X)

32. LDV, LDT1, LDT2 Tampering Rate (Catalyst Removal)

a) LDV w/o I/M
LDT1 w/o I/M
LDT2 w/o I/M

b) LDV with I/M
LDT1 with I/M
LDT2 with I/M

Format = 3(F5.3, 1X)

33. HDDT Mileage Accumulation by Age and Weight Class

a) no. of records - Format (I2)

b) each record contains mileage accumulation for class 2B, Light, Medium and Heavy HDDT - Format=(3X, 3(I5, 1X), I5)
repeat as specified in a)

34. HDDT Fleet Sales Fraction by Year and Weight Class

a) no. of records - Format (I2)

b) each record contains year and sales fraction for 2B, light, medium and heavy HDDT - Format=(I4, 1X, 4(F5.3, 1X))

35. VMT Mix

1 record with the fraction of VMT miles traveled by LDV, LDT1, LDT2, HDGV, HDDT and MC. This data has been taken from MOBILE 3 except that LDDT VMT have been split evenly between LDT1 and LDT2 since MOBILE 3 does not distinguish the two classses of LDDT.

Note 1: repeat this record as many times as specified in a). The "year" is the earliest year for which the emission factor applies.

Note 2: These records are read by the subroutine GTEMCT. Each set of records consists of:

a) This record gives the number of years each of the following records contains. The first year is automatically 1974 and earlier, the second is 1975, the third is 1976 etc. the last year is that year and later. Format =I2

b) Fraction of leaded, no catalyst by year

c) Fraction of unleaded, no catalyst by year

d) Fraction of unleaded, oxid. catalyst/no air by year

e) Fraction of unleaded oxid. catalyst/air by year

f) Fraction of unleaded 3 way catalyst by year

g) Fraction of unleaded 3 way + oxid. catalyst by year

h) Fraction of diesels by year

j) Fraction of unleaded with catalysts by year

k) Fraction of unleaded with catalysts/no air by year

l) Fraction of unleaded with catalysts/air by year

Format = 15(F5.3, 1X)

Note 3: Each set of records is read by subroutine FLTSLE and contains:

a) number of records Format = I2

b) model year, unlead sales fraction, leaded sales fraction, diesel sales fraction
repeat b) as specified in a)
Format = I4, 1X 3(F5.3, 1X)

Note 4: Each set of records is read by subroutine TRAVWT and contains 20 records. Each record contains age, registration fraction and mileage accumulation rate by age. Format = (I4, 1X, F5.3, 1X, I5)

4. OUTPUTS

Output from the program consists of prompting messages, error messages and the report on results. The report includes information on the scenario and the calculated emissions from each type of vehicle. The diagnostic messages inform the user about errors and warn about data errors that are non-fatal. Prompt messages are available if IPROMT is set to 2 or 4 in the control section. These messages prompt the user to input data in the correct sequence. In the CONTROL section there are two formats vertical flag input(2) and horizontal flag input (4). The prompt messages are the same in either case.

4.1 REPORT

Example reports are shown in Section 6. The report is divided into three sections. The first section provides scenario information. The second section gives the emission factors and the last section gives the fraction of the total particulates from each vehicle class and the fractions within each class.

The scenario information reflects information entered in the control section and parameter section. The first item is the project identification (title) which was entered as part of the control section. Next the scenario year and vehicle speed is presented. The flag settings and the driving conditions are shown next. The flag settings indicate whether the user provided data or whether the normal default data was used. In the case of the I/M flag, where there is no default value, the flag indicates whether there is an I/M program in effect.

In the second section the results of the calculations are shown. The results show the contribution of the four types of particulates to exhaust emissions from each vehicle class. For light duty vehicles, both gasoline and diesel vehicles are included in the same classes. However, it is easy to separate the contributions from diesels, since only diesel vehicles emit diesel particulates. The totals show the total grams per mile of all particulates

emitted by vehicles of each class. The VMT weighted totals are the same totals weighted by the areawide VMT travel fraction. These values are important for gauging the relative contribution from each class since there are different numbers of vehicles in each class. Particulates from brake and tire wear are added to the VMT weighted totals from exhaust emissions to get the total VMT weighted emissions.

The last section shows the fractional contribution of each particulate to the total for each vehicle class.

4.2 DIAGNOSTIC AND ERROR MESSAGES

Messages are of three types: error messages, warning messages and comments. Error messages can be fatal or non-fatal. Fatal errors cause the program to halt. Fatal errors are caused by user supplied data that the program does not understand or which is invalid and cannot be corrected by the program. Non-fatal errors are errors that do not stop execution. There occur where values are out of bounds. In some cases, the program adjusts the out of bound values to be in bounds. The program execution will halt when there are 50 non-fatal errors. Scenarios with non-fatal errors should be carefully checked for errors. Comments are useful statements about options taken. They do not affect the calculations and are present for informational purposes only. The meanings of the messages are presented in Table 4-1 for fatal errors, Table 4-2 for non-fatal errors and Table 4-3 for warnings and comments. The error number given in the tables is the code passed to the QUITER subroutine which writes the message.

TABLE 4-1

FATAL ERROR MESSAGES

Error Number	
1	**"Message Code '#'"** This is an unknown of out of bounds message it should never occur. # is the unknown message number
2	**"IPROMT Flag Out Of Bounds - Prompt Mode Type (1 to 4) Must be Corrected Before Your Next Run"** This message occurs if IPROMT is not equal to 1, 2, 3 or 4
3-8	**"'Value' Out of Bounds for 'Name of Flag' Flag"** This message indicates that the flag named has a value that is out of bounds. It should be corrected for the next run.
16	**"Range of Years for Lead Content by Year Cannot be Negative or Zero"** This message occurs when the user has set SPCFLG=2 and incorrectly specifies the range of years on the first card of the lead content of gasoline data.
17	**"'Value' intercept must be positive"** This error occurs when MISFLG=2 and the user has entered a negative zero mile misfueling rate
22	**"You Must Correct All Flags Before You Run Again"** This message occurs when one or more of the control flags is out of bounds. It ends the run. This message occurs in conjunction with errors 3-8.
23	**"End of File in OUTGEN Data File"** This error occurs when there is no more data in unit IOUGEN when the program was expecting data. This message will occur only when using a data file for user supplied data.
31	**"End of File in IOUDAT Data File"** This error occurs when the program finds an end of file in the default data file. This error occurs only when the default data has been changed.

35 **"Driving Condition Flag Must Be 1 or 2 Cannot be 'Value'"**

The user has incorrectly entered the driving conditions. Entering 1=transient or cyclic, a 2=cruise

36 **"Year Cannot Be 'Value'—Must Be Later Than 1979"**

The scenario year must be later than 1979

37 **"No Such Vehicle Class 'Value' For Registration Data"**

This error occurs when MYMRFG=3 or 4 and an incorrect vehicle class has been entered. The vehicle class must be a number between one and six.

38 **"No Fuel Type 'Value' for Registration Data"**

This error occurs when MYMRFG=3 or 4 and an invalid fuel type has been entered. The fuel type must be between one and three. (1=leaded, 2=unleaded, 3=diesel).

39 **"No Vehicle Class 'Value' for Mileage Accumulation Data"**

This error occurs when MYMRFG=2 or 4 and an invalid vehicle class has been entered. The vehicle class must be between one and six (1=LDV, 3=LDT2, 4=HDGV, 5=HDDT, 6=MC).

40 **"No Fuel Type 'Value' for Mileage Accumulation Data"**

This error occurs when MYMRFG=2 or 4 and an invalid fuel type has been entered. The fuel type must be between one and three (1 or 2=gasoline, 3=diesel)

TABLE 4-2

NON-FATAL ERROR MESSAGES

Error Number	
10	**" 'Value' Out of Bounds for VMT Mix (0. to 1.)**
	The user has specified an incorrect VMT fraction. The VMT weighted totals in the results will be incorrect.
11	**" 'Value' Sum of VMT Mix is not Equal to 1."**
	The user has specified one or more incorrect VMT fractions. The sum of the fractions does not add up to one. The VMT weighted totals in the results will be incorrect.
12	**" 'Value' Negative Model Year Mileage"**
	The user has set MYMRFG=2 or 4 and has entered a negative mileage accumulation rate. The results for this vehicle class and fuel type will be incorrect.
13	**" 'Value' Negative Model Year Registration"**
	This message occurs when MYMRFG=3 or 4 and a negative registration fraction has been entered. The results for this vehicle class will be incorrect.
19	**" 'Value' Speed Must be Positive"**
	The speed for this scenario is less than zero. The program will take the absoute value and continue execution.
28	**"Lead Content of Leaded Gas Cannot Be 'Value' for Year 'Value of Year' "**
	This message occurs when the user has set SPCFLG=2 and incorrectly specifies a negative lead content for the given year. The program makes the value positive and continues.
29	**"Lead Content of Unleaded Gas Cannot be 'Value' for Year 'Value of Year' "**
	This message occurs when the user has set SPCFLG=2 and incorrectly specifies a negative lead content for the given year. The program makes the value positive and continues.
30	**" 'Value' Tampering Rate Must be Positive or Zero"**
	This message occurs when TAMFLG=2 and the tampering rate is negative. The program sets the tampering rate to zero and continues execution.

32 **"Argument Out of Bounds in Function 'Name of Function' "**

This error indicates a bad argument was passed to the named function. This error should not occur. Contact technical assistance.

TABLE 4-3

WARNING AND COMMENT MESSAGES

Message Number	
9	**" 'Value' Speed Reduced to 55 M.P.H. Maximum"**
	The speed for the scenario was reduced to 55 mph.
14	**" 'Value' Registration with Zero Mileage"**
	This error will occur only when MYMRFG=2, 3 or 4. There is a vehicle class with a registration fraction but no mileage accumulation.
15	**" 'Value' Mileage with Zero Registration"**
	This error will occur only when MYMRFG-2, 3 or 4. There is a vehicle class with mileage accumulation but no registration fraction.
18	**" 'Value' Negative Slope for Ageing Vehicles"**
	This error will occur only when MISFLG=2 and the user has entered a negative slope, (i.e. less misfueling with mileage accumulation). Where the derived misfueling rate is negative, it is set equal to zero.
20	**" 'Value' MYR Sum not = 1. (Will Normalize)"**
	This message will occur only if MYMRFG=3 or 4 and the sum of the registration fractions do not sum to one. The program will renormalize the fractions so that they do sum to one.
21	**" 'Value' Speed Increased to 5 M.P.H. Minimum"**
	The scenario speed was less than 5 mph. The program increases it to 5 mph before proceeding.
26	**" 'Value' Particle Size Cutoff Increased to 0.1 Microns"**
	The scenario particle size cutoff was less than 0.1 microns. The program set the particle size cutoff to 0.1 microns before continuing execution.
27	**" 'Value' Particle size Cutoff Decreased to 10 Microns"**
	The scenario particle size cutoff was greater than 10 microns. The program set the particle size cutoff to 10 microns before continuing execution.

33 **"Vehicle Speed = 'Value' Less Than 19.6 M.P.H. for Sulfate Cal."**

This message simply warns that the sulfate calculations for light duty vehicles are being extrapolated.

34 **"Vehicle Speed = 'Value' Greater than 34.8"**

Same as message 33.

5. PROGRAM STRUCTURE AND NOTES

This section describes the program I/O unit assignments. It also documents the setup of the default data file which is read in prior to each run.

5.1 The Program I/O Unit Assignments

The MAIN program contains the default input and output unit numbers. The input unit numbers are stored in the variables IOUDAT and IOUGEN. IOUDAT is the unit number assigned to the deault data file. It is normally unit 4. IOUGEN is the unit designated for user input. It is normally unit 5. These assignments cannot be changed unless the MAIN program is altered. The output unit numbers are stored as IOUREP, IOUERR and IOUASK. They are the output unit for reports, error and warning messages and user prompts respectively. They are all normally assigned to unit 6. The user can change any or all output unit numbers by using the IPROMT flag to specify new numbers (see control section inputs). All of the I/O unit assignments are stored in the common block IOUCOM.

5.2 PROGRAM STRUCTURE

Figure 5-1 diagrams the program structure in terms of subroutines. The subroutines are described in Table 5-1. Each subroutine is called by the routine to the left of it on the diagram.

5.3 COMMON BLOCKS

The common blocks and the subroutines that use them are listed in Table 5-2.

5.4 GLOBAL VARIABLES

Global variables are not global in the sense that they are available to all parts of the program but are global in useage. The variables always have the same meaning wherever they appear. They are most often used as indices to arrays or as pointers. They are shown in Table 5-3.

FIGURE 5-1
PROGRAM STRUCTURE

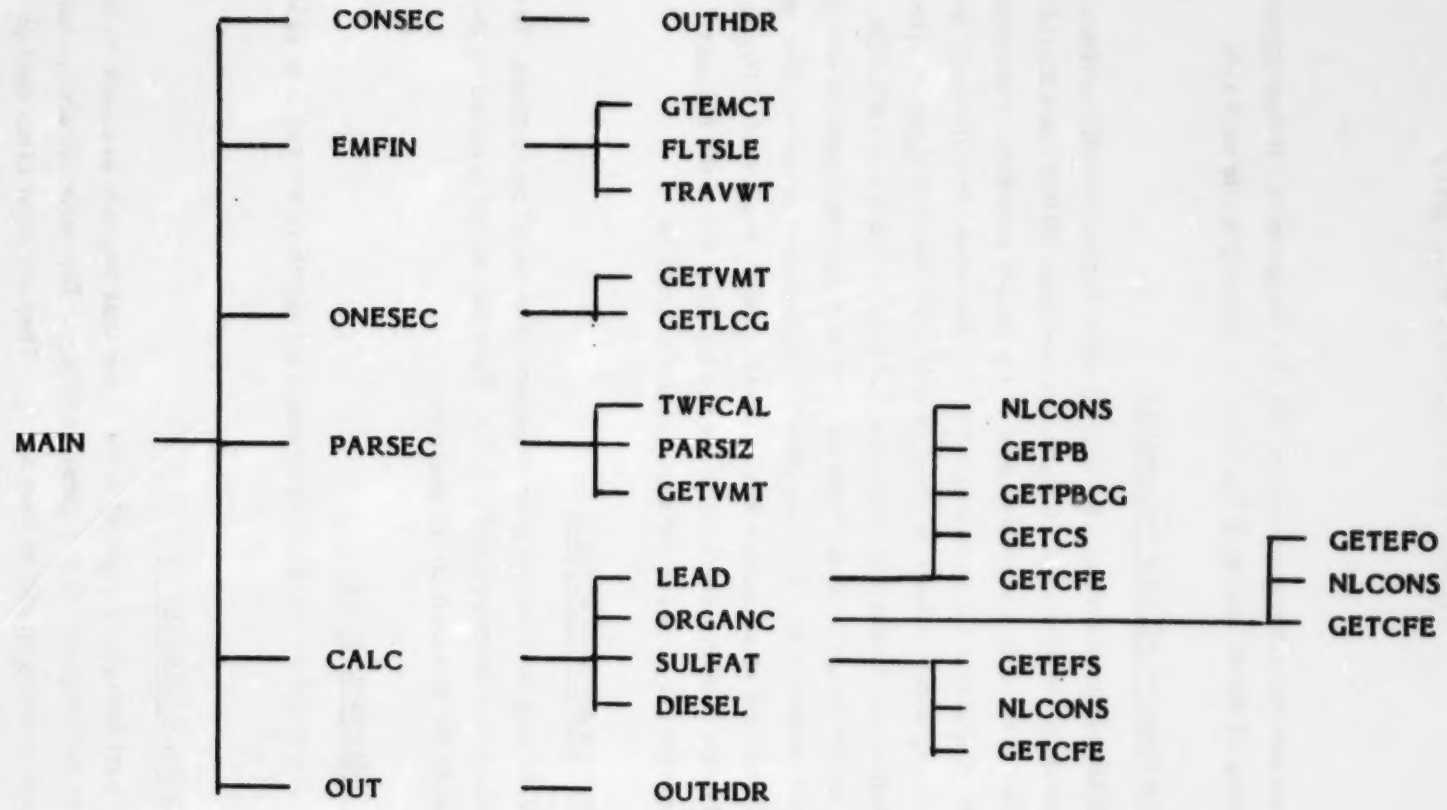

TABLE 5-1
PROGRAM MODULE DICTIONARY

MAIN	Controls overall execution of the program
CONSEC	Reads and verifies control flags
EMFIN	Reads all default data
ONESEC	Reads and verifies one time data
PARSEC	Reads parameters for each scenario
GTEMCT	Reads fractions of given vehicle class with various types of emission control technology
FLTSLE	Reads fleet sales fractions by fuel type for a given vehicle class
TRAVWT	Reads and verifies registration and mileage accumulation by age for a given vehicle class
GETVMT	Reads and verifies VMT fractions by vehicle class for area (also known as even travel fraction)
GETLCG	Reads user supplied lead content of gasoline by year
TWFCAL	Calculates travel weighting function for all vehicle classes and sets default fleet sales functions for those not previously read
PARSIZ	Calculates fraction of each particulate type which is below particle size cutoff
LEAD	Calculates total lead emission for given vehicle class, year and fuel type
NLCONS	Finds unleaded emissions factors for given year and vehicle class
GETPB	Finds leaded emissions factor for given vehicle class and year
GETPBCG	Finds amount of lead in gasoline for given year and fuel type
GETCS	Finds speed dependent correction factor for given speed
GETCFE	Finds combined city/highway fuel economy (miles per gallon) for given year and vehicle class
ORGANC	Calculates total organic emissions for given vehicle class, year and fuel type

GETEFO	Finds organic emission factor for given year, vehicle class, catalyst and fuel type
SULFAT	Calculates total sulfate emission for given vehicle class, year, speed and fuel type
GETEFS	Finds sulfate emission factor for given year, vehicle class, catalyst type, fuel and speed
DIESEL	Calculates diesel particulates for given vehicle class
OUT	Outputs results
OUTHDR	Outputs project name

TABLE 5-2

COMMON BLOCKS

Name of BLOCK	Description

1. ANSWER Contains particulate totals by type and vehicle class

PBSUM (6)	=	lead totals
ORGSUM (6)	=	organic particulate totals
SULSUM (6)	=	sulfate particulate totals
DIESUM (6)	=	diesel particulate totals
CLSSUM (6)	=	particulate totals by class
BRKSUM	=	brake wear particulate
TIRSUM	=	tire wear particulate
SUMALL	=	sum of all particulates

Block Used by CALC and OUT

2. CONST Contains fraction of lead burned that is exhausted

FPB	=	fraction of lead exhausted by non-catalyst vehicles
FPBE	=	1975-1980 misfueled vehicles
FPBL	=	1981+ misfueled vehicles

Block used by LEAD, EMFIN

3. EMCT Contains fraction of fleet with emission control devices and catalyst removal rates

FPBEMC (15,6)	-	fraction of leaded vehicles
FNLEMC (15,6,8)	-	fraction of non-leaded vehicles with catalyst type
FDIEMC (15,6)	-	fraction of diesel vehicles
IEMCYR (15)	-	model year
IEMCT	-	number of model years
TAMPER (3,2)	-	catalyst removal rates for LDV, LDTl and LDT2

For first four variables

lst index	=	year pointer
2nd index	=	vehicle class l=LDV, LDDV 4=HDGV, HDDT 2=LDTl, LDDTl 5=HDGV2 3=LDT2, LDDT2 6=MC
3rd index	=	catalyst type (non-leaded only) l=LDV, LDDV 4=HDGVl, HDDT 2=LDTl, LDDT 5=HDGV2 3=LDT2 6=MC

For TAMPER

1st index = vehicle class
2nd index = I/M flag

Block used by FREMCT, GTEMCT, ONESEC, NLCONS, SULFAT

4. **EMDIE** Contains Diesel Emission Factors

IDIEYR (20) - year
IDIEVH (20) - vehicle class
EFDP (20) - emission factor
NDITDT - no. of entries

Block used by EMFIN, DIESEL

5. **EMORG** Contains organic emission factors

IORGYR (20) - year
IORGFT (20) - fuel type
IORGCT (20) - catalyst type
IORGVH (20) - vehicle class
EFO (20) - emission factor
NORTDT - no. of entries

Block used by EMFIN, GETEFO

6. **EMPB** Contains lead emission factors

EFLEAD (20) - lead emission factor
IPBYR (20) - year
IPBVH (20) - vehicle class
IPBFT (20) - fuel type
NPBTDT - no. of entries

Block used by EMFIN, GETPB

7. **EMSUL** Contains sulfate emission factors

ISULYR (20) - year
ISULFT (20) - fuel type
ISULCT (20) - catalyst type
ISULVH (20) - vehicle class
EFS (20,2) - emission factor, speed
NSUTDT - no. of entries

Block used by EMFIN, GETEFS

8. **FLAGSI** Contains control flags (see control section)

Block used by CONSEC, EMFIN, ONESEC, PARSEC, GETLCG, GETVMT, NLCONS, OUT

9. **FLEET** Contains fleet sales fractions and VMT mix

FSF (26,6,3) - fleet sales fractions
- 1st index = index
- 2nd index = vehicle class
- 3rd index = fuel type

IFSFYR (26,6) = model year
- 1st index = index
- 2nd index = model year

IFSF (6) = highest index by vehicle class
VMT (6) = VMT fraction by vehicle class

Block used by TWFCAL, FLTSLE, GETVMT, CALC, FRFLT, OUT, EMFIN

10. **GAS** Contains lead content of gasoline, city/highway, fuel economy and vehicle speed correction

LCGSIZ - no. of lead content entries
LCGYR (20) - year for lead content
PBCG (20,2) - lead content of gasoline
- 1st index = index
- 2nd index = fuel type (1=leaded, 2=unleaded)

NCFEYR (27) - Year for fuel economy
CFE (27,6) - miles per gallon by vehicle class
- 1st index = index
- 2nd index = vehicle class

1=LDV	4=HDGV1
2=LDT1	5=HDGV2
3=LDT3	HDGV

ICFESZ - no. of entries for city/highway fuel economy
IFECSZ - no. of entries for speed corrections
FECUS (13) - vehicle speed
FEC (13,2) - speed correction
- 1st index = index
- 2nd index = driving conditions (1=cyclic, 2=steady)

Block used by EMFIN, GETUCG, GTPBCG, GETCS, GETCFE

11. **HDDT** Contains heavy duty diesel truck mileage accumulation

IHTRG - no. of entries
IHDDTMA (20,4) - HDDT mileage accumulation rate
- 1st index = age
- 2nd index = wt class

1=2B	3=med HDDT
2=Lt. HDDT	4=heavy HDDT

IHDDYR (21) - calendar year
HDDTRG (21,4) - registration fraction
- 1st index = index
- 2nd index = wt. class

12. **HDDV** Contains HDDT low altitude g^m/bhp-hr to g^m/mile conversion factors

IHDDMY (13) - model year
HDDVCF (13) - conversion factor

Block used by EMFIN, DIESEL

13. **MSFL** Contains misfueling rates

RMISFL (20,4,2) - misfueling
1st index = age
2nd index = vehicle class
3rd index = IMFLAG
TMISFL (6,2) = simple misfueling rates
1st index = vehicle class
2nd index = IMFLAG

Block used by EMFIN, ONESEC and NLCONS

14. **PROJCM** Contains project title

PROJID - title

Block used by CONSEC, OUT, OUTHDR

15. **PSIZE** Contains particle size cumulative fraction for chosen particle size cutoff

PSZCUT = particle size cutoff
PSL = cumulative fraction for leaded vehicles
PSNL = cumulative fraction for non-leaded vehicles w/o catalyst
PSNLCT = cumulative fraction for non-leaded vehicles with catalyst
PSDIE = cumulative fraction for diesel vehicles
PSBRK = cumulative fraction for brake wear
PSTIRE = cumulative fraction for tire wear

Block used by ONESEC, PARSEC, PARSIZ, LEAD, ORGANC, SULFAT, DIESEL, CALC, OUT

16. **PSDIST** Contains particle size distribution

PSDIST (5,2,6) - particle size distribution
- 1st index = index
- 2nd index = 1=size
  2=cumulative fraction
- 3rd index = source
  1=leaded
  2=unleaded with catalyst
  3=unleaded w/o catalyst
  4=diesel
  5=brake
  6=tire

Block used by EMFIN, PARSIZ

17. **SCENR** Contains scenario variables

IYEAR - scenario year
VEHSPD - vehicle speed
IDRIV - driving conditions
1=cyclic or transient
2=steady cruise

Block used by EMFIN, PARSEC, CALC, OUT

TABLE 5-3
GLOBAL VARIABLES

Name	Range	Purpose
IAGE	1-20	Age of vehicle in years
IFT	1-3	Fuel Type 1=leaded gas 2=unleaded gas 3=diesel
IVHCLS	1-6	Vehicle class 1=LDV, LDDV 2=LDT1, LDDT1 3=LDT2, LDDT2 4=HDGV, HDDT 5=HDGV2 6=MC
	Note that this scheme is slightly different than the vehicle classes the user uses to input data and interpret results.	
IYRPTR	1980+	Calendar Year

5.5 OTHER PROGRAM NOTES

The vehicle classes inside the program are defined differently in comparison to the vehicle classes as defined in the original report. In the report the classes were defined as: 1) LDV and LDDV, 2) LDT1 and LDDT1, 3) LDT2 and LDDT2, 4) HDGV, 5) HDDT, and 6) MC. As far as the user is concerned the program treats vehicle classes in the exact same way as the report.

Inside the program, the vehicle classes are defined in terms of vehicle class and fuel type. The first three classes are unchanged and motorcycles are still the sixth class. However, HDDT are now part of the fourth class when the emissions factors are called and calculations done. HDGV2 are considered as the fifth class since they have different fuel economy than HDGV. This split in the definition at vehicle classes lasts until the subroutine CALC is called. CALC changes the definitions back to those found in the orignal report.

6. EXAMPLES

The following examples were run on the Ann Arbor MTS system to demonstrate both interactive and batch use of the program. The compiled source code was in the file "-load" and the associated data file was "partic.ef.da". The examples are:

1. No tampering (catalyst removal) scenario for 1985 and 1990 with transient driving conditions, vehicle speed 25 mph and including particles up to 10 microns in size. Program run interactively with prompts for user input.
2. No misfueling scenario for 1990 and 1995 with transient driving conditions, vehicle speed 25 mph and including particle size cutoffs of 10 microns for both years and 5 microns for 1990. Program run interactively with prompts for user input.
3. Alternate lead content of gasoline for1985 to 1990. A 1990 example with vehicle speed 25 mph transient driving conditions and a 10 micron size cutoff was run. Program was run interactively.
4. A user specified VMT mix is used for each scenario. Three cases are run for 1985 with vehicle speed 30 mph, transient driving conditions and a particle size cutoff of 10 microns for the first two cases and 5 microns for the last case. The program was run in batch mode with no prompts printed. The user specified data was a a file "example 1" assigned to unit 5. The normal exit is flagged by the message "END OF FILE IN IOUGEN DATA FILE".
5. Alternate tampering rates, LDV registration and mileage accumulation with age and alternate misfueling rates scenario. The user data is in file "example 2". The tampering rates for LDV, LDT1 and LDT2 are set to .100, .100 and 0.150 respectively in line 4. Gasoline powered LDV registration rates are altered in lines 5-8 and gasoline LDV mileage accumulation rates are altered in lines 9-12. The zero mileage misfueling rates and slopes with mileage for LDV, LDT1, LDT2 and HDGV1 are given in lines 13-16. The program was run for 1987 with vehicle speed 25 mph, cruising driving conditions and particle size cutoff 5 microns.

```
$run -load 4=partic.ef.da
4000
```

EXAMPLE 1

```
Enter project id:
test example -- no tampering
ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG
2 1 1 1 1 1

ENTER FRACTION OF CATALYST EQUIPPED VEHICLES WITH
CATALYST REMOVED FOR LDV, LDT1 AND LDT2 FORMAT=3(F4.3,1X)
NO I/M PROGRAM IN IN EFFECT
.000 .000 .000


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1985
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00


TEST EXAMPLE -- NO TAMPERING

CALCULATIONS FOR YEAR 1985  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = USER   MISFUELING RATES  = NORM    VMT MIXTURE         = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS  = NORM
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0130   0.0234   0.0091    0.0178   0.0583     0.7845     0.0457
  LDT1      0.0243   0.0303   0.0066    0.0195   0.0808     0.0827     0.0067
  LDT2      0.0443   0.0286   0.0059    0.0195   0.0983     0.0470     0.0046
  HDGV      0.0987   0.1422   0.0023    0.0      0.2432     0.0419     0.0102
  HDDT      0.0      0.0      0.0       1.9198   1.9198     0.0354     0.0680
   MC       0.0311   0.0      0.0       0.0      0.0311     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1500

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD     ORGANIC  SULFATE  DIESEL
  LDV       0.2224   0.4019   0.1557   0.2200
  LDT1      0.3007   0.3753   0.0822   0.2417
  LDT2      0.4501   0.2912   0.0601   0.1985
  HDGV      0.4059   0.5846   0.0095   0.0
  HDDT      0.0      0.0      0.0      1.0000
   MC       1.0000   0.0      0.0      0.0


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1990
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00
```

```
TEST EXAMPLE -- NO TAMPERING

CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = USER   MISFUELING RATES  = NORM    VMT MIXTURE         = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS  = NORM
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD     ORGANIC   SULFATE   DIESEL    TOTAL     VMT FRAC.  VMT WT. TOTAL
  LDV       0.0057   0.0195    0.0085    0.0174    0.0512      0.7845     0.0401
  LDT1      0.0136   0.0234    0.0071    0.0434    0.0876      0.0817     0.0072
  LDT2      0.0236   0.0228    0.0078    0.0434    0.0976      0.0470     0.0046
  HDGV      0.0591   0.0938    0.0100    0.0       0.1478      0.0419     0.0070
  HDDT      0.0      0.0       0.0       1.7319    1.7319      0.0354     0.0613
   MC       0.0294   0.0       0.0       0.0       0.0294      0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0175
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1351

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD     ORGANIC   SULFATE   DIESEL
  LDV       0.1117   0.3817    0.1671    0.3395
  LDT1      0.1550   0.2677    0.0812    0.4961
  LDT2      0.2419   0.2335    0.0796    0.4449
  HDGV      0.3520   0.5587    0.0593    0.0
  HDDT      0.0      0.0       0.0       1.0000
   MC       1.0000   0.0       0.0       0.0

ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
!
+Attention interrupt at 35365E
#$!
#Attn!
#
```

EXAMPLE 2

```
 $run -load 4=partic.ef.da
#Invalid MTS command
#$run -load 4=partic.ef.da
4 000

 Enter project id:
 test example -- no misfueling
 ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG
 1 1 1 2 1 1
 ENTER FOR  LDV ZERO MILE MISFUELING RATE AND SLOPE        --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR LDT1 ZERO MILE MISFUELING RATE AND SLOPE        --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR LDT2 ZERO MILE MISFUELING RATE AND SLOPE        --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR HDT1 ZERO MILE MISFUELING RATE AND SLOPE        --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000


 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 1990
 ENTER VEHICLE SPEED -- (FORMAT = F4.1)
 25.000
 ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
 1
 ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
 10.000


 TEST EXAMPLE -- NO MISFUELING

 CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

 FLAG SETTINGS:
  TAMPERING RATES    = NORM   MISFUELING RATES  = USER    VMT MIXTURE         = NORM
  MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS  = NORM
  DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

 VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL    TOTAL     VMT FRAC.  VMT WT. TOTAL
   LDV       0.0024   0.0159   0.0100    0.0174    0.0456     0.7845     0.0358
   LDT1      0.0046   0.0152   0.0109    0.0434    0.0741     0.0827     0.0061
   LDT2      0.0128   0.0152   0.0119    0.0434    0.0833     0.0470     0.0039
   HDGV      0.0591   0.0961   0.0121    0.0       0.1674     0.0419     0.0070
   HDDT      0.0      0.0      0.0       1.7319    1.7319     0.0354     0.0613
    MC       0.0294   0.0      0.0       0.0       0.0294     0.0085     0.0003
 TOTAL BRAKE PARTICULATES = 0.0125
 TOTAL TIRE PARTICULATES  = 0.0020
 TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1290

                PARTICULATE FRACTION BY VEHICLE CLASS
 VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL
   LDV       0.0525   0.3481   0.2188    0.3806
   LDT1      0.0624   0.2047   0.1470    0.5859
   LDT2      0.1538   0.1820   0.1428    0.5213
   HDGV      0.3530   0.5745   0.0726    0.0
   HDDT      0.0      0.0      0.0       1.0000
    MC       1.0000   0.0      0.0       0.0
```

EXAMPLE 2 (cont)

```
ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1995
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.000


TEST EXAMPLE -- NO MISFUELING

CALCULATIONS FOR YEAR 1995  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = NORM   MISFUELING RATES  = USER    VMT MIXTURE        = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL    TOTAL     VMT FRAC.  VMT WT. TOTAL
  LDV       0.0007   0.0149   0.0088    0.0210    0.0454      0.7845     0.0356
  LDT1      0.0008   0.0124   0.0104    0.0670    0.0906      0.0827     0.0075
  LDT2      0.0031   0.0124   0.0126    0.0670    0.0951      0.0470     0.0045
  HDGV      0.0349   0.0680   0.0180    0.0       0.1209      0.0419     0.0051
  HDDT      0.0      0.0      0.0       1.6606    1.6606      0.0354     0.0588
   MC       0.0294   0.0      0.0       0.0       0.0294      0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1262

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL
  LDV       0.0160   0.3278   0.1948    0.4614
  LDT1      0.0085   0.1370   0.1152    0.7394
  LDT2      0.0326   0.1303   0.1328    0.7043
  HDGV      0.2887   0.5622   0.1491    0.0
  HDDT      0.0      0.0      0.0       1.0000
   MC       1.0000   0.0      0.0       0.0
```

EXAMPLE 2 (cont)

```
 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 1990
 ENTER VEHICLE SPEED -- (FORMAT = F4.1)
 25.000
 ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
 1
 ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
  5.00


 TEST EXAMPLE -- NO MISFUELING

 CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF = 5.00 MICRONS

 FLAG SETTINGS:
  TAMPERING RATES     = NORM   MISFUELING RATES  = USER    VMT MIXTURE         = NORM
  MILEAGE & REGIST.   = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS  = NORM
  DRIVING CONDITIONS  = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

 VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL    TOTAL     VMT FRAC.  VMT WT. TOTAL
   LDV       0.0020   0.0149   0.0095    0.0164    0.0428      0.7845     0.0336
   LDT1      0.0038   0.0141   0.0103    0.0411    0.0693      0.0827     0.0057
   LDT2      0.0103   0.0139   0.0113    0.0411    0.0766      0.0470     0.0036
   HDGV      0.0471   0.0783   0.0113    0.0       0.1367      0.0419     0.0057
   HDDT      0.0      0.0      0.0       1.6395    1.6395      0.0354     0.0580
    MC       0.0234   0.0      0.0       0.0       0.0234      0.0085     0.0002
 TOTAL BRAKE PARTICULATES = 0.0106
 TOTAL TIRE PARTICULATES  = 0.0010
 TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1185

                  PARTICULATE FRACTION BY VEHICLE CLASS
 VEH.CLASS   LEAD     ORGANIC  SULFATE  DIESEL
   LDV       0.0470   0.3482   0.2209   0.3839
   LDT1      0.0547   0.2029   0.1490   0.5934
   LDT2      0.1349   0.1813   0.1471   0.5367
   HDGV      0.3444   0.5729   0.0827   0.0
   HDDT      0.0      0.0      0.0      1.0000
    MC       1.0000   0.0      0.0      0.0


 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 !
+Attention interrupt at 35385E
#
```

```
Enter project title:
test example -- alternate lead content for 1985 to 1990
ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG ....
 1 1 1 1 2 1
```

EXAMPLE 3

```
ALTERNATE LEAD CONTENT OF GASOLINE BY YEAR
ENTER FIRST AND LAST YEAR TO CHANGE - (I4,1X,I4)
1985 1990

ENTER LEAD CONTENT OF GASOLINE FOR  LEADED              AND UNLEADED -- FORMAT=F5.3,1X,F5.3
FOR YEAR  1985
1.050 0.010
FOR YEAR  1986
1.050 0.010
FOR YEAR  1987
1.050 0.005
FOR YEAR  1988
1.050 0.005
FOR YEAR  1989
1.050 0.005
FOR YEAR  1990
1.050 0.005


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1990
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00


TEST EXAMPLE -- ALTERNATE LEAD CONTENT FOR 1985 TO 1990

CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = NORM   MISFUELING RATES  = NORM    VMT MIXTURE         = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = USER
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0052  0.0195   0.0085   0.0174   0.0506     0.7845     0.0397
  LDT1      0.0139  0.0234   0.0071   0.0434   0.0879     0.0827     0.0073
  LDT2      0.0237  0.0228   0.0078   0.0434   0.0977     0.0470     0.0046
  HDGV      0.0559  0.0988   0.0100   0.0      0.1647     0.0419     0.0069
  HDDT      0.0     0.0      0.0      1.7319   1.7319     0.0354     0.0613
   MC       0.0294  0.0      0.0      0.0      0.0294     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1346

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
  LDV       0.1027  0.3856   0.1688   0.3429
  LDT1      0.1584  0.2666   0.0809   0.4941
  LDT2      0.2426  0.2333   0.0795   0.4445
  HDGV      0.3397  0.5999   0.0604   0.0
  HDDT      0.0     0.0      0.0      1.0000
   MC       1.0000  0.0      0.0      0.0
```

```
:Unexpected operand at end of command
:p *f *l
:      1     3
:      2     TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO
:      3     1 2 1 1 1 1
:      4     1985
:      5     30.0
:      6     1
:      7     10.00
:      8     0.750 0.100 0.100 0.050 0.000 0.000
:      9     1985
:     10     30.0
:     11     1
:     12     10.00
:     13     0.600 0.100 0.100 0.050 0.150 0.000
:     14     1985
:     15     30.0
:     16     1
:     17      5.00
:     18     0.600 0.100 0.100 0.050 0.150 0.000
:$run -load 4=partic.ef.da 5=example1
```

EXAMPLE 4

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
TAMPERING RATES = NORM MISFUELING RATES = NORM VMT MIXTURE = SCEN
MILEAGE & REGIST. = NORM I/M PROGRAM = NO SPECIAL CONDITIONS = NORM
DRIVING CONDITIONS = TRAN

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0120	0.0234	0.0096	0.0128	0.0578	0.7500	0.0434
LDT1	0.0235	0.0303	0.0069	0.0195	0.0803	0.1000	0.0080
LDT2	0.0418	0.0286	0.0062	0.0195	0.0962	0.1000	0.0096
HDGV	0.0987	0.1422	0.0023	0.0	0.2432	0.0500	0.0122
HDDT	0.0	0.0	0.0	1.9198	0.0	0.0	0.0
MC	0.0311	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.0877

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.2077	0.4051	0.1655	0.2217
LDT1	0.2932	0.3776	0.0859	0.2432
LDT2	0.4350	0.2978	0.0643	0.2030
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	0.0
MC	0.0	0.0	0.0	0.0

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:

TAMPERING RATES	= NORM	MISFUELING RATES	= NORM	VMT MIXTURE	= SCEN
MILEAGE & REGIST.	= NORM	I/M PROGRAM	= NO	SPECIAL CONDITIONS	= NORM
DRIVING CONDITIONS	= TRAN				

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0170	0.0234	0.0096	0.0128	0.0578	0.6000	0.0347
LDT1	0.0235	0.0303	0.0069	0.0195	0.0803	0.1000	0.0080
LDT2	0.0418	0.0286	0.0062	0.0195	0.0962	0.1000	0.0096
HDGV	0.0987	0.1422	0.0023	0.0	0.2432	0.0500	0.0122
HDDT	0.0	0.0	0.0	1.9198	1.9198	0.1500	0.2880
MC	0.0311	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.3670

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.2077	0.4051	0.1655	0.2217
LDT1	0.2932	0.3776	0.0859	0.2432
LDT2	0.4350	0.2978	0.0643	0.2030
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	1.0000
MC	0.0	0.0	0.0	0.0

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO
aM}wDwyl

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF = 5.00 MICRONS

FLAG SETTINGS:

TAMPERING RATES	= NORM	MISFUELING RATES	= NORM	VMT MIXTURE	= SCEN
MILEAGE & REGIST.	= NORM	I/M PROGRAM	= NO	SPECIAL CONDITIONS	= NORM
DRIVING CONDITIONS	= TRAN				

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0096	0.0204	0.0090	0.0121	0.0512	0.6000	0.0307
LDT1	0.0188	0.0253	0.0065	0.0185	0.0691	0.1000	0.0069
LDT2	0.0333	0.0238	0.0058	0.0185	0.0814	0.1000	0.0081
HDGV	0.0785	0.1130	0.0018	0.0	0.1933	0.0500	0.0097
HDDT	0.0	0.0	0.0	1.8174	1.8174	0.1500	0.2726
MC	0.0247	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0106
TOTAL TIRE PARTICULATES = 0.0010
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.3397

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.1881	0.3983	0.1766	0.2369
LDT1	0.2719	0.3666	0.0940	0.2675
LDT2	0.4096	0.2920	0.0713	0.2271
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	1.0000
MC	0.0	0.0	0.0	0.0

```
$edit example2
:p *f *l
:      1      3
:      2      TEST EXAMPLE - ALT. TAMPERING, LDV REG.&MILEAGE, MISFUELING
:      3      2 1 4 2 1 1
:      4      .100 .100 .150
:      5      1 1
:      6       .100 .100 .100 .100 .050 .050 .050 .050 .050 .050
:      7       .030 .030 .030 .030 .030 .030 .030 .030 .030 .030
:      8      0 0
:      9      1 1
:     10      15000 14000 13000 12000 11000 10000 10000 10000 10000 10000
:     11       9000  8000  7000  6000  5000  4000  4000  4000  4000  4000
:     12      0 0
:     13      0.050000 0.000100
:     14      0.060000 0.000200
:     15      0.070000 0.000200
:     16      0.070000 0.000200
:     17      1987
:     18      25.00
:     19      2
:     20       5.00
:
```

TEST EXAMPLE - ALT. TAMPERING, LDV REG.&MILEAGE, MISFUELING

CALCULATIONS FOR YEAR 1987 SPEED 25.0 MPH PARTICLE CUTOFF = 5.00 MICRONS

FLAG SETTINGS:

TAMPERING RATES	= USER	MISFUELING RATES	= USER	VMT MIXTURE	= NORM
MILEAGE & REGIST.	= M+R	I/M PROGRAM	= NO	SPECIAL CONDITIONS	= NORM
DRIVING CONDITIONS	= CRSE				

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0167	0.0343	0.0011	0.0146	0.0667	0.7845	0.0523
LDT1	0.0199	0.0320	0.0007	0.0272	0.0799	0.0827	0.0066
LDT2	0.0304	0.0297	0.0007	0.0272	0.0881	0.0470	0.0041
HDGV	0.0762	0.1097	0.0018	0.0	0.1876	0.0419	0.0079
HDDT	0.0	0.0	0.0	1.7342	1.7342	0.0354	0.0614
MC	0.0242	0.0	0.0	0.0	0.0242	0.0085	0.0002

TOTAL BRAKE PARTICULATES = 0.0106
TOTAL TIRE PARTICULATES = 0.0010
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.1442

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.2510	0.5138	0.0164	0.2188
LDT1	0.2497	0.4003	0.0094	0.3406
LDT2	0.3449	0.3377	0.0085	0.3089
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	1.0000
MC	1.0000	0.0	0.0	0.0

**ERROR 23:
END OF FILE IN IOUGEN DATA FILE

APPENDIX A

SOURCE CODE LISTING

```
      C THIS IS PROGRAM CALCULATES LEAD, ORGANIC, SULFATE AND
      C PARTICULATE EMISSIONS.  IT IS DESIGNED TO BE SIMILIAR IN
      C FORMAT TO MOBILE3.
      C
      C PREPARED FOR E.P.A. BY:  ENERGY AND ENVIRONMENTAL ANALYSIS
      C                          1655 NORTH FORT MEYER DRIVE
      C                          ARLINGTON VA 22209
      C
      C
      C MAIN PROGRAM
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      C
      C DEFAULT UNIT ASSIGNMENTS
      C DATA FILE (DEFAULT EMISSION FACTORS)
            IOUDAT=4
      C USER SUPPLIED DATA
            IOUGEN=5
      C OUTPUT REPORT
            IOUREP=6
      C C ERROR REPORT
            IOUERR=6
      C PROMPTS
            IOUASK=6
      C
      C READ CONTROL SECTION
            CALL CONSEC(&99)
      C READ DATA TABLES
            CALL EMFIN
            INERR=0
      C READ ONETIME DATA
            CALL ONESEC(INERR,&99)
            IF(INERR.GT.50)GOTO 20
      C READ PARAMETER SECTION (SCENARIOS)
         10 CALL PARSEC(INERR,&99)
            IF(INERR.GT.50)GOTO 20
      C CALCULATIONS
            CALL CALC
      C OUTPUT
            CALL OUT
            GOTO 10
         99 STOP
         20 WRITE(IOUERR,1000)
       1000 FORMAT('0','EXCESS DATA ERRORS PREVENT FURTHER ANALYSIS')
            END
      C
      C ****************************************
      C * INPUT ROUTINES                       *
      C ****************************************
      C
      C
            SUBROUTINE CONSEC(*)
      C
      C  CONSEC reads in and validates the Control Section flags.  It also sets the
      C  input mode for the run, resets the output units (if requested) and reads in
      C  and stores the run title.
      C
      C  Called by MAIN.
      C
```

```
C  Calls MOD (FORTRAN library function), OUTHDR and QUITER.
C
C  Input on call:
C
C    common blocks:
C
C  Output on return:
C
C    common blocks:
C    /IOUCOM/ IOUREP,IOUERR,IOUASK
C    /PROJCM/ PROJID
C
C  Local array subscripts:
C
C  IOUCHG(9)  -  IOUCHG ( JU )
C  IOUOLD(3)  -  IOUOLD ( JOU )
C  IOUREF(9)  -  IOUREF ( JU )
C  NAMFLG(13) -  NAMFLG ( IFG )
C
C  Local variable / array dictionary:
C
C   Name   Type              Description
C   ------ ----  ------------------------------------------------------------
C  FLGERR   I    number of flag values found to be out of range
C  INFORM   I    dummy variable: QUITER call purpose is to write out run
C                'inform'ation, not an error or a warning message
C  IOUCHG   I    user entered changes to output unit assignments
C  IOUOLD   I    output unit numbers to be used this run
C  IOUREF   I    character representations of i/o unit numbers 1 - 9
C  IOUSUM   I    sum of acceptable changed i/o unit numbers
C  IPRSAV   I    backup of entered IPROMT - used in QUITER if out of range
C  JUNIT    I    potential numeric match to entered character for unit change
C  MDEFLG   I    decides prompt & read format for Control Section flags:
C                  1 = vertical format     2 = horizontal format
C  NAMFLG   R*8  flag names for prompts
C
C
      INTEGER TAMFLG,SPCFLG,VMFLAG
C
      COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MVMRFG,IMFLAG,MISFLG
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      COMMON /PROJCM/ PROJID(20)
C
      INTEGER FLGERR
      DIMENSION IOUREF(9),IOUOLD(3),IOUCHG(3)
      REAL*8 NAMFLG(13),NAMFNC(2)
C
      EQUIVALENCE
     *   (IOUOLD(1),IOUREP),   (IOUOLD(2),IOUERR),   (IOUOLD(3),IOUASK)
C
      DATA FLGERR/0/
      DATA IOUREF/
     *   '1   ','2   ','3   ','4   ','5   ','6   ','7   ','8   ','9   '/
C
     , DATA NAMFLG/' TAMFLG:',' VMFLAG:',' MVMRFG:',
     &             ' MISFLG:',' SPCFLG:',' IMFLAG:'/
     &,NAMFNC/' FREMCT ',' FRFLT  '/
C
```

```
C  Read in prompt/mode flag and output unit changes (if any).
C
      READ(IOUGEN,100,END=99) IPROMT,IOUCHG
  100 FORMAT(I1,3A1)
C
C  Output unit numbers parsed here.
C
C  Change alphanumeric to numeric values.
C
      DO 20 JOU=1,3
C
C  Test for allowed values (no input units).
C
      DO 10 JU=1,9
      IF(JU.EQ.IOUGEN)GOTO 10
      IF(JU.EQ.IOUDAT)GOTO 10
      JUNIT=JU
      IF(IOUCHG(JOU).EQ.IOUREF(JU)) GOTO 15
   10 CONTINUE
C
C  Set default for unrecognized value.
C
      JUNIT=0
   15 IOUCHG(JOU)=JUNIT
   20 CONTINUE
C
C  Assign output units.
C
      IOUSUM=0
      DO 25 JOU=1,3
      IOUSUM=IOUCHG(JOU)+IOUSUM
      IF(IOUCHG(JOU).GT.0) IOUOLD(JOU)=IOUCHG(JOU)
   25 CONTINUE
C
C  Parse prompt/mode flag here.
C
C  Save input flag for future possible abort.
C
      IPRSAV=IPROMT
      IF(IPROMT.GE.1.AND.IPROMT.LE.4) GOTO 30
C
C  Abort will happen due to prompt/mode flag error.
C  Collect title for id of possible multiple units.
C
      IPROMT=1
      WRITE(IOUASK,210)
      READ(IOUGEN,110,END=99) PROJID
      GOTO 60
C
C  Parse prompt/mode flag.
C
   30 MDEFLG=1
      IF(IPROMT.GE.3)MDEFLG=2
      IPROMT=MOD(IPROMT-1,2)+1
C
C  Read title.
C
   55 IF(IPROMT.EQ.2) WRITE(IOUASK,210)
```

```
  210 FORMAT('0','Enter project id:')
      READ(IOUGEN,110,END=99) PROJID
  110 FORMAT(20A4)
C
C  If error unit no longer same as report unit, write run title to it.
C
   60 IF(IOUREP.NE.IOUERR) CALL OUTHDR(IOUERR)
C
C  Display unit number values if changed.
C
      IF(IOUSUM.GT.0) CALL QUITER(0.,0,71,INFORM)
      IF(IPROMT.EQ.2.AND.IOUASK.NE.IOUREP.AND.IOUASK.NE.IOUERR)
     *   CALL OUTHDR(IOUASK)
C
C  Reset INITPR so that subsequent branch check in OUTPUT will succeed.
C
      INITPR=1
C
C  Test IPRSAV (= entered IPROMT value).  Out-of-range => run stops.
C
      IF(IPRSAV.LT.1.OR.IPRSAV.GT.4) CALL QUITER(0.,IPRSAV,2,FLGERR)
C
      IF(MDEFLG.EQ.2) GOTO 65
C
C  Read flags via vertical input mode.
C
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(1)
      READ(IOUGEN,120,END=99) TAMFLG
      IF(TAMFLG.LT.1.OR.TAMFLG.GT.2) CALL QUITER(0.,TAMFLG,3,FLGERR)
      IF(IPROMT.EQ.2)WRITE(IOUASK,220)NAMFLG(2)
      READ(IOUGEN,120,END=99) VMFLAG
      IF(VMFLAG.LT.1.OR.VMFLAG.GT.3) CALL QUITER(0.,VMFLAG,5,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(3)
      READ(IOUGEN,120,END=99) MYMRFG
      IF(MYMRFG.LT.1.OR.MYMRFG.GT.4) CALL QUITER(0.,MYMRFG,6,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(4)
      READ(IOUGEN,120,END=99)MISFLG
      IF(MISFLG.LT.1.OR.MISFLG.GT.3) CALL QUITER(0.,MISFLG,4,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(5)
      READ(IOUGEN,120,END=99) SPCFLG
      IF(SPCFLG.LT.1.OR.SPCFLG.GT.3)CALL QUITER(0.,SPCFLG,7,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(6)
      READ(IOUGEN,120,END=99) IMFLAG
      IF(IMFLAG.LT.1.OR.IMFLAG.GT.2) CALL QUITER(0.,IMFLAG,8,FLGERR)
C
  120 FORMAT(I1)
  220 FORMAT(' ','Enter',A8)
C
      GOTO 70
C
C  Read flags in via horizontal mode.
C
   65 IF(IPROMT.EQ.2) WRITE(IOUASK,230)
  230 FORMAT(' ','ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG')
      READ(IOUGEN,130,END=99) TAMFLG,VMFLAG,MYMRFG,MISFLG,SPCFLG,IMFLAG
  130 FORMAT(I1,12(1X,I1))
      IF(TAMFLG.LT.1.OR.TAMFLG.GT.2) CALL QUITER(0.,TAMFLG,3,FLGERR)
      IF(MISFLG.LT.1.OR.MISFLG.GT.3) CALL QUITER(0.,MISFLG,4,FLGERR)
```

```
      IF(VMFLAG.LT.1.OR.VMFLAG.GT.3) CALL QUITER(0.,VMFLAG,5,FLGERR)
      IF(MYMRFG.LT.1.OR.MYMRFG.GT.4) CALL QUITER(0.,MYMRFG,6,FLGERR)
      IF(SPCFLG.LT.1.OR.SPCFLG.GT.2) CALL QUITER(0.,SPCFLG,7,FLGERR)
      IF(IMFLAG.LT.1.OR.IMFLAG.GT.2) CALL QUITER(0.,IMFLAG,8,FLGERR)
C
C  1 or more flag values out of range => warn user & then stop run.
C
   70 IF(FLGERR.GT.0) CALL QUITER(0.,0,53,FLGERR)
      RETURN
C
C  EOF on any attempted read => take alternate return 1 => run aborts.
C
   99 RETURN1
      END
      SUBROUTINE QUITER(RVALUE,IVALUE,MESSAG,INERR)
C
C  QUITER prints error and warning messages on unit IOUERR.
C
C  CALLED BY CONSEC, PARSEC, ONSEC, GETVMT, GETLCG, FREMCT, FRFLT
C
C  Input on call:
C
C    parameter list: RVALUE,IVALUE,MESSAG,INERR
C    common blocks:
C    /IOUCOM/ IOUREP,IOUERR,IOUASK
C
C  Output on return:
C
C    parameter list: INERR
C
C  Warning: there is a conditional branch to STOP at statement number 98.
C
C  Local array subscripts:
C
C  IOBMSG(5)  -  IOBMSG ( ICH )
C  NAMFLG(15) -  NAMFLG ( ICH )
C  NAMFNC(16) -  NAMFNC ( ICH )
C  NAMVEH(8)  -  NAMVEH ( IV )
C
C  Local variable / array dictionary:
C
C   Name   Type              Description
C  ------  ----  ------------------------------------------------------
C  IOBMSG   I    character string vector: 'out of bounds for'
C  MAXMES   I    maximum message code value ( = 83 in MOBILE3 release version)
C  MCODE    I    = MESSAG = message code, unless < 0 or > MAXMES => = 1
C  NAMFLG   R*8  control flag names + 'Unknown'
C  NAMFNC   R*8  function names (to identify subprogram source of error)
C  NAMVEH   R*8  vehicle type names
C
C
C
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
C
      DIMENSION IOBMSG(5)
C
      REAL*8 NAMFLG(8),NAMVEH(6),NAMFNC(2)
C
```

```
      DATA NAMFLG/
     *    ' Unknown',
     *    ' IPROMT ',
     *    ' TAMFLG ',
     *    ' MISFLG ',
     *    ' VMFLAG ',
     *    ' MYMRFG ',
     *    ' SPCFLG ',
     *    ' IMFLAG '/
C
      DATA NAMVEH/
     *   'LDV     ',
     *   'LDT 1   ',
     *   'LDT 2   ',
     *   'HDGV    ',
     *   'HDDT    ',
     *   'MC      '/
C
      DATA NAMFNC/'FREMCT  ','FRFLT   '/
C
      DATA IOBMSG/
     *   '  ou','t of',' bou','nds ','for '/
C
      DATA MAXMES/40/
C
      MCODE=MESSAG
C
C  Trap unknown errors.
C
      IF(MCODE.LT.1.OR.MCODE.GT.MAXMES) MCODE=1
C
C  Test for warnings.
C
      IF(MCODE.NE.9.AND.MCODE.NE.14.AND.MCODE.NE.15.AND.MCODE.NE.18
     *             .AND.MCODE.NE.20.AND.MCODE.NE.21.AND.MCODE.NE.25
     *             .AND.MCODE.NE.26.AND.MCODE.NE.27.AND.MCODE.NE.28
     *             .AND.MCODE.NE.29.AND.MCODE.NE.33.AND.MCODE.NE.34
     *  )WRITE(IOUERR,300)MCODE
  300 FORMAT('-','**ERROR ',I2,':')
C
C  Branch to the appropriate error / warning message.
C
      GOTO(
     *     10,11,11,11,11,11,11,11,16,17,
     *     18,19,20,21,22,29,30,31,39,49,
     *     52,53,60,61,71,72,73,74,75,76,
     *     77,78,79,80,81,82,83,84,85,86
     *        ),MCODE
C
   10 WRITE(IOUERR,310) MESSAG,NAMFLG(MCODE)
  310 FORMAT('+',10X,'Message code ',I4,A8)
      GOTO 98
   11 WRITE(IOUERR,311) IVALUE,IOBMSG,NAMFLG(MCODE)
  311 FORMAT('+',10X,I4,5A4,'flag',A8)
      IF(MCODE.EQ.2) WRITE(IOUERR,312)
  312 FORMAT(' ','Prompt/mode type (1 to 4) must be corrected before',
     *       ' your next run.')
      GOTO 98
```

```
      16 WRITE(IOUERR,316) RVALUE
     316 FORMAT(' ','Warning: ',G10.3,' speed reduced to 55 m.p.h.',
        *  ' maximum')
         GOTO 99
      17 WRITE(IOUERR,317) RVALUE,IOBMSG
     317 FORMAT('+',10X,G10.3,5A4,'VMT MIX (0. to 1.)')
         GOTO 98
      18 WRITE(IOUERR,318) RVALUE
     318 FORMAT('+',10X,G10.3,' sum of VMT MIX is not equal to 1.')
         GOTO 98
      19 WRITE(IOUERR,319) IVALUE
     319 FORMAT('+',10X,G10.3,' negative model year mileage')
         GOTO 98
      20 WRITE(IOUERR,320) RVALUE
     320 FORMAT('+',10X,G10.3,' negative model year registration')
         GOTO 98
      21 WRITE(IOUERR,321) RVALUE
     321 FORMAT(' ','Warning: ',G10.3,' registration with zero mileage')
         GOTO 99
      22 WRITE(IOUERR,322) RVALUE
     322 FORMAT(' ','Warning: ',G10.3,' mileage with zero registration')
         GOTO 99
      29 WRITE(IOUERR,329)
     329 FORMAT('+',10X,' RANGE OF YEARS FOR LEAD CONTENT CANNOT BE <= 0')
         GOTO 98
      30 WRITE(IOUERR,330) RVALUE
     330 FORMAT('+',10X,G10.3,' intercept must be positive')
         GOTO 98
      31 WRITE(IOUERR,331) RVALUE
     331 FORMAT(' ','Warning: ',G10.3,' negative slope for ageing vehicle')
         GOTO 99
      39 WRITE(IOUERR,339) RVALUE
     339 FORMAT('+',10X,G10.3,' speed must be positive')
         GOTO 98
      49 WRITE(IOUERR,349) RVALUE
     349 FORMAT(' ','Warning: ',G10.3,' MVR sum not = 1. (will normalize)')
         GOTO 99
      52 WRITE(IOUERR,352) RVALUE
     352 FORMAT(' ','Warning: ',G10.3,' speed increased',
        *                             ' to 5 m.p.h. minimum')
         GOTO 99
      53 WRITE(IOUERR,353)
     353 FORMAT('0','You must correct all flags before you run again.')
         GOTO 98
      60 WRITE(IOUERR,360)
     360 FORMAT('+',10X,' END OF FILE IN IOUGEN DATA FILE')
         GOTO 98
      61 WRITE(IOUERR,360) INERR,NAMFNC(IVALUE)
     361 FORMAT('+',10X,' DEFAULT USED FOR',I5,' IN INDEX FUNCTION',A8)
         GOTO 98
      71 WRITE(IOUERR,371) IOUREP,IOUERR,IOUASK
     371 FORMAT(' ','COMMENT: CURRENT OUTPUT UNIT NUMBERS ARE ',
        *' IOUREP=',I1,' IOUERR=',I1,' IOUASK=',I1)
         GOTO 99
      72 WRITE(IOUERR,372) RVALUE
     372 FORMAT('+',10X,G10.3,' PARTICLE SIZE CUTOFF INCREASED TO 0.1 MICRONS')
         GOTO 98
      73 WRITE(IOUERR,373) RVALUE
```

```
      373 FORMAT('+',10X,G10.3,' PARTICLE SIZE CUTOFF IS DECREASED TO 10 MICRONS')
          GOTO 98
       74 WRITE(IOUERR,374)RVALUE,IVALUE
      374 FORMAT('+',10X,' LEAD CONTENT OF LEADED GAS CANNOT BE ',G10.3,
     &' FOR YEAR',I5)
          GOTO 98
       75 WRITE(IOUERR,375)RVALUE,IVALUE
      375 FORMAT('+',10X,' LEAD CONTENT OF UNLEADED GAS CANNOT BE ',G10.3,
     &' FOR YEAR',I5)
          GOTO98
       76 WRITE(IOUERR,376) RVALUE
      376 FORMAT('+',10X,G10.3,' TAMPERING RATE MUST BE POSITIVE OR ZERO --',G10.3)
          GOTO 98
       77 WRITE(IOUERR,377)
      377 FORMAT('+',10X,' END-OF-FILE IN IOUDAT DATA FILE')
          GOTO 99
       78 WRITE(IOUERR,378)NAMFNC(IVALUE)
      378 FORMAT('+','ARGUMENT OUT OF BOUNDS IN FUNCTION ',A8)
          GOTO 98
       79 WRITE(IOUERR,379) RVALUE
      379 FORMAT(' ','WARNING: VEHICLE SPEED =',G10.3,' LESS THAN 19.6 MPH FOR SULFATE CAL.')
          GOTO 98
       80 WRITE(IOUERR,380) RVALUE
      380 FORMAT(' ','WARNING: VEHICLE SPEED =',G10.3,' MORE THAN 34.8 MPH FOR SULFATE CAL.')
          GOTO 98
       81 WRITE(IOUERR,381)IVALUE
      381 FORMAT('+',10X,'DRIVING CONDITION FLAG MUST BE 1 OR 2 CANNOT BE ',I2)
          GOTO 98
       82 WRITE(IOUERR,382) IVALUE
      382 FORMAT('+',10X,'YEAR CANNOT BE ',I4,' -- MUST BE LATER THAN 1979')
          GOTO 98
       83 WRITE(IOUERR,383) IVALUE
      383 FORMAT('+',10X,'NO SUCH VEH. CLASS ',I2,' FOR REGISTRATION DATA')
          GOTO 98
       84 WRITE(IOUERR,384) IVALUE
      384 FORMAT('+',' NO SUCH FUEL TYPE ',I4,' FOR REGISTRATION DATA')
          GOTO 98
       85 WRITE(IOUERR,385) IVALUE
      385 FORMAT('+',10X,'NO VEH. CLASS ',I4,' FOR MILEAGE ACCUMULATION DATA')
          GOTO 98
       86 WRITE(IOUERR,386) IVALUE
      386 FORMAT('+',10X,'NO FUEL TYPE ',I4,' FOR MILEAGE ACCUMULATION DATA')
          GOTO 98
C
       98 IF(MCODE.EQ.1.OR.MCODE.EQ.2.OR.MCODE.EQ.10.OR.MCODE.EQ.12
     &                  .OR.MCODE.EQ.16.OR.MCODE.EQ.17.OR.MCODE.EQ.19
     &                  .OR.MCODE.EQ.22.OR.MCODE.EQ.23
     &                  .OR.MCODE.EQ.30.OR.MCODE.EQ.31.OR.MCODE.EQ.35
     &                  .OR.MCODE.EQ.36.OR.MCODE.EQ.37.OR.MCODE.EQ.38
     &                  .OR.MCODE.EQ.39.OR.MCODE.EQ.40) STOP
          INERR=INERR+1
C
       99 RETURN
          END
C
          SUBROUTINE EMFIN
C
C READ DATA TABLES FROM UNIT IOUDAT
```

```
      C
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
            COMMON/EMORG/IORGYR(20),IORGFT(20),IORGCT(20),IORGVH(20),
           &EFO(20),NORTOT
            COMMON/EMSUL/ISULYR(20),ISULFT(20),ISULCT(20),ISULVH(20),
           &EFS(20,2),NSUTOT
            COMMON/EMDIE/IDIEYR(20),IDIEVH(20),EFDP(20),NDITOT
            COMMON/EMPB/EFLEAD(20),IPBYR(20),IPBVH(20),IPBFT(20),NPBTOT
            COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
           &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
            COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
            COMMON/PSTEMP/PSDIST(5,2,6)
            COMMON/SCENR/IYEAR,VEHSPD,IDRIV
            COMMON/CONST/FPB,FPBE,FPBL
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
            COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDYR(21),HDDTRG(21,4)
            COMMON/HDDV/IHDDMY(13),HDDVCF(13)
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
      C
      C LDV LDT1 LDT2 ORGANIC  - 6 RECORDS
       1001 FORMAT(I2)
            READ(IOUDAT,1001)NORG1
            NORTOT=NORG1
       1000 FORMAT(I4,3X,I1,1X,I1,1X,F5.3)
            DO 10 I=1,NORG1
            READ(IOUDAT,1000,END=999)IORGYR(I),IORGCT(I),IORGFT(I),EFO(I)
         10 IORGVH(I)=1
      C
      C LDV LDT1 LDT2 SULFATES 13 RECORDS
      C
       1010 FORMAT(I4,3X,I1,1X,I1,1X,F4.1,1X,F5.3)
            READ(IOUDAT,1001)NSUL1
            NSUTOT=NSUL1
            DO 20 I=1,NSUL1
            READ(IOUDAT,1010,END=999)ISULYR(I),ISULCT(I),ISULFT(I),
           &EFS(I,2),EFS(I,1)
         20 ISULVH(I)=1
      C
      C LDDV  DIESEL 3 RECORDS
      C
            READ(IOUDAT,1001)NDIES1
            NDITOT=NDIES1
       1020 FORMAT(I4,1X,F5.3)
            DO 30 I=1,NDIES1
            READ(IOUDAT,1020,END=999)IDIEYR(I),EFDP(I)
            IDIEVH(I)=1
         30 CONTINUE
      C
      C LDDT  DIESEL 3 RECORDS
      C
            READ(IOUDAT,1001)NDIES2
            NDITOT=NDITOT+NDIES2
            NDINXT=NDIES1+1
            DO 40 I=NDINXT,NDITOT
            READ(IOUDAT,1020,END=999)IDIEYR(I),EFDP(I)
```

```
523           IDIEVH(I)=2
524        40 CONTINUE
525     C
526     C HDGV   ORGANIC   4 RECORDS
527     C
528           READ(IOUDAT,1001)NORG2
529           NORNXT=NORTOT+1
530           NORTOT=NORTOT+NORG2
531           DO 50 I=NORNXT,NORTOT
532           READ(IOUDAT,1000,END=999)IORGVR(I),IORGCT(I),IORGFT(I),EFO(I)
533        50 IORGVH(I)=4
534     C
535     C HDGV  SULFATE  3 RECORDS
536     C
537           READ(IOUDAT,1001)NSUL2
538           NSUNXT=NSUTOT+1
539           NSUTOT=NSUTOT+NSUL2
540           DO 60 I=NSUNXT,NSUTOT
541           READ(IOUDAT,1025,END=999)ISULVR(I),ISULCT(I),ISULFT(I),EFS(I,1)
542      1025 FORMAT(I4,3X,I1,1X,I1,1X,F5.3)
543           ISULVH(I)=4
544        60 EFS(I,2)=0.0
545     C
546     C HDDT  DIESEL  1 RECORD
547     C
548           READ(IOUDAT,1001)NDIES3
549           NDINXT=NDITOT+1
550           NDITOT=NDITOT+NDIES3
551           DO 70 I=NDINXT,NDITOT
552           READ(IOUDAT,1020,END=999)IDIEVR(I),EFDP(I)
553        70 IDIEVH(I)=4
554     C
555     C LDV LDT1    LEAD   6 RECORDS
556     C
557           READ(IOUDAT,1001,END=999)IPB
558      1030 FORMAT(I4,1X,I1,1X,F5.3)
559           NPBTOT=IPB
560           DO 80 I=1,NPBTOT
561           IPBVH(I)=1
562        80 READ(IOUDAT,1030,END=999)IPBVR(I),IPBFT(I),EFLEAD(I)
563     C
564     C LDT2   LEAD    6 RECORDS
565     C
566           READ(IOUDAT,1001,END=999)IPB
567           NPBNXT=NPBTOT+1
568           NPBTOT=NPBTOT+IPB
569           DO 90 I=NPBNXT,NPBTOT
570           READ(IOUDAT,1030,END=999)IPBVR(I),IPBFT(I),EFLEAD(I)
571        90 IPBVH(I)=3
572     C
573     C MC   LEAD   2 RECORDS
574     C
575           READ(IOUDAT,1001,END=999)IPB
576           NPBNXT=NPBTOT+1
577           NPBTOT=NPBTOT+IPB
578           DO 95 I=NPBNXT,NPBTOT
579           READ(IOUDAT,1030,END=999)IPBVR(I),IPBFT(I),EFLEAD(I)
580        95 IPBVH(I)=6
```

```
      C
      C READ TABLE 2-2 LEAD CONTENT OF GASOLINE BY YEAR
      C
           READ(IOUDAT,1001,END=999)LCGSIZ
 1040 FORMAT(I4,1X,F4.2,1X,F5.3)
           DO 300 I=1,LCGSIZ
  300 READ(IOUDAT,1040,END=999)LCGYR(I),(PBCG(I,IFT),IFT=1,2)
      C
      C READ TABLE 2-3  LDV EMCT
      C
           CALL GTEMCT(1)
      C
      C READ TABLE 2-4  LDV FLEET SALES FRACTIONS
      C
           CALL FLTSLE(1)
      C
      C READ TABLE 2-5  LDV TRAVEL WEIGHTING
      C
           CALL TRAVWT(1,1)
      C
      C READ TABLE 2-6  CITY/HIGHWAY FUEL ECONOMY
      C
           READ(IOUDAT,1001,END=999)ICFESZ
 1050 FORMAT(I4,1X,4(F4.1,1X),2(F3.1,1X))
           DO 310 I=1,ICFESZ
           READ(IOUDAT,1050)NCFEYR(I),(CFE(I,IVC),IVC=1,6)
           IF(NCFEYR(I).LE.1986)CFE(I,4)=CFE(I,6)
  310 CONTINUE
      C
      C READ TABLE 2-7  FUEL ECONOMY SPEED CORRECTIONS
      C
           READ(IOUDAT,1001,END=999)IFECSZ
 1060 FORMAT(F4.1,1X,F5.3,1X,F5.3)
           DO 320 I=1,IFECSZ
  320 READ(IOUDAT,1060,END=999)FECVS(I),(FEC(I,ID),ID=1,2)
      C
      C READ TABLES FOR LDT1 AND LDT2
      C
           DO 330 IVHCLS=2,3
            CALL GTEMCT(IVHCLS)
            CALL FLTSLE(IVHCLS)
            CALL TRAVWT(IVHCLS,1)
  330 CONTINUE
      C
      C READ TABLE 2-14  LDDT TRAVEL WEIGHTING
      C
           CALL TRAVWT(2,3)
      C
      C READ TABLE 2-15  HDGV FLEET SALES
      C
           CALL FLTSLE(4)
      C
      C READ TABLE 2-16  HDGV TRAVEL WEIGHTING
      C
           CALL TRAVWT(4,1)
      C
      C READ TABLE 2-17 HDDT REGISTRATION VS AGE
      C
```

```
      READ(IOUDAT,1001,END=999)IHDDT
 1065 FORMAT(3X,F5.3)
      DO 335 IAGE=1,IHDDT
  335 READ(IOUDAT,1065)TWFREG(IAGE,4,3)
C
C READ TABLE 2-18 MOTORCYCLE TRAVEL WEIGHTING
C
      CALL TRAVWT(6,1)
C
C READ TABLE 2-19 MISFUELING
C
 1070 FORMAT(5X,F4.2,1X,F4.2)
      DO 350 IVHCLS=1,6
      IF (IVHCLS.EQ.5) GOTO 340
      READ(IOUDAT,1070,END=999)WRGIM,WRGNIM
  340 TMISFL(IVHCLS,1)=WRGNIM
      TMISFL(IVHCLS,2)=WRGIM
  350 CONTINUE
C
C READ TABLE 2-19A  MISFUELING
C
      READ(IOUDAT,1001,END=999)IRMIS
 1080 FORMAT(3X,8F4.2)
      DO 360 IAGE=1,IRMIS
      READ(IOUDAT,1080,END=999)((RMISFL(IAGE,J,K),K=1,2),J=1,4)
  360 CONTINUE
C
C READ TABLE 2-20  PARTICLE SIZE ML, MNL.C,MNL.NC,MD,MB
C
      DO 365 I=1,5
      DO 365 J=1,2
      DO 365 K=1,6
  365 PSDIST(I,J,K)=0.0
 2000 FORMAT(5(F5.2,1X))
      DO 370 J=1,3
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,J),I=1,3)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,J),I=1,3)
  370 CONTINUE
      DO 380 J=4,5
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,J),I=1,5)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,J),I=1,5)
  380 CONTINUE
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,6),I=1,2)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,6),I=1,2)
C
C READ TABLE 2-21  HDDV CONVERSION FACTORS
C
      READ(IOUDAT,1001,END=999)IHDDT
 2010 FORMAT(I4,1X,F6.4)
      READ(IOUDAT,2010,END=999)(IHDDMY(I),HDDVCF(I),I=1,IHDDT)
C
C READ TABLE 2-22 FRACTION OF LEAD BURNED
C 1. NON-MISFUELED 2. 1975-1980 MISFUELED 3. 1981+ MISFUELED
C
 2020 FORMAT(3(F4.2,1X))
  800 READ(IOUDAT,2020,END=999)FPB,FPBE,FPBL
C
C READ TABLE 2-23 CATALYST REMOVAL RATE (TAMPERING)
```

```
      C
       2030 FORMAT(3(F5.3,1X))
            READ(IOUDAT,2030,END=999)((TAMPER(I,J),I=1,3),J=1,2)
      C
      C READ TABLE A-1 AVE ANNUAL MILEAGE FOR HDDT
      C
            READ(IOUDAT,1001,END=999)IHDTMA
       2040 FORMAT(3X,3(I5,1X),I5)
            DO 382 IAGE=1,IHDTMA
        382 READ(IOUDAT,2040,END=999)(IHDDMA(IAGE,IWT),IWT=1,4)
      C
      C READ TABLE A-2 PROJECTIONS OF HEAVY DUTY VEHICLES IN OPERATION
      C
            READ(IOUDAT,1001,END=999)IHTRG
       2050 FORMAT(I4,1X,4(F5.3,1X))
            DO 385 IVR=1,IHTRG
            READ(IOUDAT,2050,END=999)IHDDVR(IVR),(HDDTRG(IVR,IWT),IWT=1,4)
        385 CONTINUE
      C
      C READ DEFAULT VMT MIX
      C
            READ(IOUDAT,2060)(VMT(IVHCLS),IVHCLS=1,6)
       2060 FORMAT(6(F6.4,1X))
      C
      C SET OTHER DEFAULT FLEET SALES FRACTIONS
      C
            IFSF(6)=20
            DO 405 I=1,20
      C ALL HDDT USE DIESEL FUEL
            FSF(I,4,3)=1.
      C ALL MOTORCYCLES USE LEADED GAS
            FSF(I,6,1)=1.
            FSF(I,6,2)=0.0
            FSF(I,6,3)=0.0
            IFSFYR(I,6)=1900
        405 CONTINUE
            RETURN
        999 CALL QUITER(0.,0,31,INERR)
            RETURN
            END
      C
      C
            SUBROUTINE TWFCAL(IYEAR)
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
            COMMON/TWFRAC/TWFAC(20,6,3)
            COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDVR(21),HDDTRG(21,4)
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
            DIMENSION TWFSUM(6,3)
      C CALCULATE HDDT MILEAGE ACCUMULATION
      C
            IVRPTR=1
            DO 390 I=1,IHTRG
        390 IF(IHDDVR(I).GE.IYEAR.AND.IVRPTR.EQ.1)IVRPTR=I
            ITWFMA(1,4,3)=0
            DO 400 IAGE=2,20
            HDDTWT=0.0
            HDDSUM=0.0
            DO 395 IWT=1,4
```

```
      HDDTWT=HDDTWT+HDDTRG(IVRPTR,IWT)
  395 HDDSUM=HDDSUM+IHDDMA(IAGE-1,IWT)*HDDTRG(IVRPTR,IWT)
  400 ITWFMA(IAGE,4,3)=HDDSUM/HDDTWT
C
C CALCULATE TRAVEL FRACTION BY AGE
C
      DO 410 IVHCLS=1,6
      DO 410 IFT=1,3
      TWFSUM(IVHCLS,IFT)=0.0
      DO 410 IAGE=1,20
  410 TWFSUM(IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)*
     CITWFMA(IAGE,IVHCLS,IFT)+TWFSUM(IVHCLS,IFT)
      DO 420 IVHCLS=1,6
      DO 420 IFT=1,3
      DO 420 IAGE=1,20
      IF(TWFSUM(IVHCLS,IFT).NE.0.0)
     &TWFAC(IAGE,IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)*
     &ITWFMA(IAGE,IVHCLS,IFT)/TWFSUM(IVHCLS,IFT)
      IF(TWFSUM(IVHCLS,IFT).EQ.0.0)TWFAC(IAGE,IVHCLS,IFT)=0.0
  420 CONTINUE
      RETURN
      END
C
C
      SUBROUTINE TRAVWT(IVHCLS,IFT)
C READ TRAVEL WEIGHTING FACTOR BY VEH.CLASS AND FUEL TYPE
C
      COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
 1300 FORMAT(I2,1X,F5.3,1X,I5)
      DO 10 I=1,20
   10 READ(IOUDAT,1300)IAGE,TWFREG(I,IVHCLS,IFT),ITWFMA(I,IVHCLS,IFT)
      IF(IFT.EQ.1)GOTO 40
      IF(IVHCLS.EQ.2.AND.IFT.EQ.3)GOTO 20
      GOTO 60
C SOME CLASSES HAVE EQUIV. WEIGHTING
C LDDT I AND LDDT II
   20 DO 30 I=1,20
      TWFREG(I,3,IFT)=TWFREG(I,IVHCLS,IFT)
   30 ITWFMA(I,3,IFT)=ITWFMA(I,IVHCLS,IFT)
      GOTO 60
   40 DO 50 I=1,20
C LDDV AND LDV
      IF(IVHCLS.EQ.1)TWFREG(I,IVHCLS,3)=TWFREG(I,IVHCLS,1)
      IF(IVHCLS.EQ.1)ITWFMA(I,IVHCLS,3)=ITWFMA(I,IVHCLS,1)
C HDGV1 AND HDGV2
      IF(IVHCLS.EQ.4)TWFREG(I,5,1)=TWFREG(I,IVHCLS,1)
      IF(IVHCLS.EQ.4)ITWFMA(I,5,1)=ITWFMA(I,IVHCLS,1)
C LEAD AND UNLEAD
      TWFREG(I,IVHCLS,2)=TWFREG(I,IVHCLS,1)
      ITWFMA(I,IVHCLS,2)=ITWFMA(I,IVHCLS,1)
   50 CONTINUE
   60 RETURN
      END
C
C
      SUBROUTINE GTEMCT(IVHCLS)
C READ FRACTION OF VEHICLES WITH VARIOUS EMISSION CONTROL DEVICES
```

```
      C
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
       1101 FORMAT(I2)
            READ(IOUDAT,1101)IEMCT
      C READ LEADED FRACTION
       1100 FORMAT(15(F5.3,1X))
            READ(IOUDAT,1100)(FPBEMC(I,IVHCLS),I=1,IEMCT)
      C UNLEADED FRACTIONS
            DO 20 I=1,5
         20 READ(IOUDAT,1100)(FNLEMC(J,IVHCLS,I),J=1,IEMCT)
      C DIESEL FRACTION
            READ(IOUDAT,1100)(FDIEMC(J,IVHCLS),J=1,IEMCT)
      C MORE UNLEADED FRACTIONS
            DO 30 I=6,8
         30 READ(IOUDAT,1100)(FNLEMC(J,IVHCLS,I),J=1,IEMCT)
            IEMCYR(1)=1900
            DO 40 I=2,15
         40 IEMCYR(I)=1973+I
            RETURN
            END
      C
      C
            SUBROUTINE FLTSLE(IVHCLS)
      C READ FLEET SALES
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
            READ(IOUDAT,1200)NFSF
            IFSF(IVHCLS)=NFSF
       1200 FORMAT(I2)
       1210 FORMAT(I4,1X,3(F5.3,1X))
            DO 10 I=1,NFSF
            IF(IVHCLS.LE.3)READ(IOUDAT,1210)IFSFYR(I,IVHCLS),
           &FSF(I,IVHCLS,2),FSF(I,IVHCLS,1),FSF(I,IVHCLS,3)
            IF(IVHCLS.EQ.4)READ(IOUDAT,1210)IFSFYR(I,IVHCLS),
           &FSF(I,IVHCLS,2),FSF(I,IVHCLS,1)
         10 CONTINUE
         40 RETURN
            END
      C
      C
            SUBROUTINE ONESEC(INERR,*)
      C ONE TIME DATA SECTION
            INTEGER TAMFLG,SPCFLG,VMFLAG
            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MVMRFG,IMFLAG,MISFLG
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
      C
            DIMENSION CLSNM(6)
      C
            DATA CLSNM/' LDV','LDT1','LDT2','HDT1','HDT2',' MC '/
      C
      C ALTERNATE TAMPERING RATES
```

```
      IF(TAMFLG.EQ.1)GOTO 60
      IF(IPROMT.EQ.2)WRITE(IOUASK,200)
  200 FORMAT('0','ENTER FRACTION OF CATALYST EQUIPPED VEHICLES WITH'/
     &'CATALYST REMOVED FOR LDV, LDT1 AND LDT2 FORMAT=3(F4.3,1X)')
      IF(IMFLAG.EQ.1.AND.IPROMT.EQ.2.)WRITE(IOUASK,210)
      IF(IMFLAG.EQ.2.AND.IPROMT.EQ.2.)WRITE(IOUASK,220)
  210 FORMAT('NO I/M PROGRAM IN IN EFFECT')
  220 FORMAT('I/M PROGRAM IS IN EFFECT')
      READ(IOUGEN,225)(TAMPER(I,IMFLAG),I=1,3)
  225 FORMAT(3(F4.3,1X))
      DO 5 I=1,3
      IF(TAMPER(I,IMFLAG).LT.0.0)CALL QUITER(TAMPER(I,IMFLAG),0,30,INERR)
    5 IF(TAMPER(I,IMFLAG).LT.0.0)TAMPER(I,IMFLAG)=0.0
C
C ALTERNATE VEHICLE MILEAGE DISTRIBUTION
C
   60 IF(VMFLAG.NE.3)GOTO 10
      IF(IPROMT.EQ.2)WRITE(IOUASK,272)
  272 FORMAT(' ENTER VMT FRACTIONS FOR LDV, LDT1, LDT2, HDGV, HDDT, MC
     C -6(F5.3,1X)')
      CALL GETVMT(INERR,&99)
C ALTERNATE REGISTRATION AND MILEAGE ACCUMULATION
C
   10 IF(MYMRFG.EQ.1)GOTO 65
      IF(MYMRFG.LT.3)GOTO 30
      IF(IPROMT.EQ.2)WRITE(IOUASK,230)
  230 FORMAT('0','ALTERNATE REGISTRATION '/
     &' ENTER VEHICLE CLASS(1-6) & FUEL TYPE(1-3)  FORMAT -- I1,1X,I1'/
     &' ENTER 0,0 AS LAST VEHICLE CLASS AND FUEL TYPE')
      READ(IOUGEN,235)IVHCLS,IFT
  235 FORMAT(I1,1X,I1)
      IF(IVHCLS.LE.0)GOTO 30
      IF(IVHCLS.LT.1.OR.IVHCLS.GE.6)CALL QUITER(0.,IVHCLS,37,INERR)
      IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,IFT,38,INERR)
      IF(IVHCLS.EQ.6)IFT=1
      IF(IVHCLS.EQ.4)IFT=1
      IF(IVHCLS.EQ.5)IFT=3
      IF(IVHCLS.EQ.5)IVHCLS=4
      IF(IPROMT.EQ.2)WRITE(IOUASK,240)CLSNM(IVHCLS)
  240 FORMAT(' ENTER ',A4,' FRACTION OF REGISTRATION FOR AGES 1-10',
     &'  FORMAT -- 10F5.3')
      READ(IOUGEN,260,END=99)(TWFREG(IAGE,IVHCLS,IFT),IAGE=1,10)
      IF(IPROMT.EQ.2)WRITE(IOUASK,250)CLSNM(IVHCLS)
  250 FORMAT(' ENTER ',A4,' FRACTION OF REGISTRATION FOR AGES 11-20+',
     &'  FORMAT -- 10F5.3')
      READ(IOUGEN,260,END=99)(TWFREG(IAGE,IVHCLS,IFT),IAGE=11,20)
  260 FORMAT(10F5.3)
      CHKREG=0.0
      DO 25 IAGE=1,20
      IF(TWFREG(I,IVHCLS,IFT).LT.0.)
     * CALL QUITER(TWFREG(I,IVHCLS,IFT),0,13,INERR)
   25 CHKREG=CHKREG+TWFREG(IAGE,IVHCLS,IFT)
      IF (ABS(CHKREG-1.).GE.0.001)CALL QUITER(CHKREG,0,20,INERR)
      IF(ABS(CHKREG-1.).LT.001)GOTO 10
      DO 27 IAGE=1,20
      TWFREG(IAGE,IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)/CHKREG
      IF(IFT.EQ.1)TWFREG(IAGE,IVHCLS,2)=TWFREG(IAGE,IVHCLS,IFT)
   27 IF(IFT.EQ.2)TWFREG(IAGE,IVHCLS,1)=TWFREG(IAGE,IVHCLS,IFT)
```

```
      GOTO 10
C
C ALTERNATE MILEAGE ACCUMULATION RATES
C
 30 IF(MYMRFG.NE.2.AND.MYMRFG.NE.4)GOTO 65
    IF(IPROMT.EQ.2)WRITE(IOUASK,265)
265 FORMAT('0','ALTERNATE MILEAGE ACCUMULATION RATES'/
   &' ENTER VEHICLE CLASS(1-6) & FUEL TYPE(1-3)  FORMAT -- I1,1X,I1'/
   &' ENTER 0,0 AS LAST VEHICLE CLASS AND FUEL TYPE')
    READ(IOUGEN,235)IVHCLS,IFT
    IF(IVHCLS.LE.0)GOTO 65
    IF(IVHCLS.GT.6)CALL QUITER(0.,IVHCLS,39,INERR)
    IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,IFT,40,INERR)
    IF(IVHCLS.EQ.6)IFT=1
    IF(IVHCLS.EQ.4)IFT=1
    IF(IVHCLS.EQ.5)IFT=3
    IF(IVHCLS.EQ.5)IVHCLS=4
    IF(IPROMT.EQ.2)WRITE(IOUASK,270)CLSNM(IVHCLS)
267 FORMAT(9(I5,1X),I5)
270 FORMAT('0','ENTER ANNUAL MILEAGE ACCUMULATION FOR ',A4,
   &' AGES 1-10 FORMAT -- 10(I5,1X)')
271 FORMAT('0','ENTER ANNUAL MILEAGE ACCUMULATION FOR ',A4,
   &' AGES 11-20+  FORMAT 10(I5,1X)')
    READ(IOUGEN,267,END=99)(ITWFMA(IAGE,IVHCLS,IFT),IAGE=1,10)
    IF(IPROMT.EQ.2)WRITE(IOUASK,271)CLSNM(IVHCLS)
    READ(IOUGEN,267,END=99)(ITWFMA(IAGE,IVHCLS,IFT),IAGE=11,20)
    DO 50 IAGE=1,20
    IF(ITWFMA(IAGE,IVHCLS,IFT).EQ.0.AND.TWFREG(IAGE,IVHCLS,IFT).NE.0.0)
   & CALL QUITER(TWFREG(IAGE,IVHCLS,IFT),0,14,INERR)
    IF(ITWFMA(IAGE,IVHCLS,IFT).NE.0.AND.TWFREG(IAGE,IVHCLS,IFT).EQ.0.0)
   & CALL QUITER(TWFREG(IAGE,IVHCLS,IFT),0,15,INERR)
 50 IF(ITWFMA(IAGE,IVHCLS,IFT).LT.0) CALL
   * QUITER(0.,ITWFMA(IAGE,IVHCLS,IFT),12,INERR)
    GOTO 30
C
C
C MISFUELING BY VEHICLE CLASS MILEAGE ACCUMULATION
C
 65 IF(MISFLG.EQ.1.OR.MISFLG.EQ.3) GOTO 80
    DO 70 IVHCLS=1,4
    IF(IPROMT.EQ.2)WRITE(IOUASK,275)CLSNM(IVHCLS)
275 FORMAT('ENTER FOR ',A4,' ZERO MILE MISFUELING RATE AND SLOPE
   & --FORMAT=F8.6,1X,F8.6')
    READ(IOUGEN,280)RMISZM,RMISSL
280 FORMAT(F8.6,1X,F8.6)
    IF(RMISZM.LT.0)CALL QUITER(RMISZM,0,17,INERR)
    IF(RMISSL.LT.0)CALL QUITER(RMISSL,0,18,INERR)
    ITMSUM=0.0
    DO 70 IAGE=1,20
    ITMSUM=ITMSUM+ITWFMA(IAGE,IVHCLS,2)
    RMISFL(IAGE,IVHCLS,IMFLAG)=RMISZM+RMISSL*ITMSUM
 70 IF(RMISFL(IAGE,IVHCLS,IMFLAG).GT.1.0)RMISFL(IAGE,IVHCLS,IMFLAG)=1.0
C
C
C ALTERNATE LEAD CONTENT OF GASOLINE
C
 80 IF(SPCFLG.EQ.2)CALL GETLCG(INERR,&99)
 90 RETURN
```

```
  987          99 RETURN1
  988             END
  989       C
  990       C
  991             SUBROUTINE PARSEC(INERR,*)
  992       C
  993       C PARAMETER SECTION AND NORMAL USER INPUTS
  994       C
  995             INTEGER TAMFLG,SPCFLG,VMFLAG
  996             COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
  997             COMMON/SCENR/IYEAR,VEHSPD,IDRIV
  998             COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
  999             COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
 1000       C READ YEAR FOR WHICH CALULATION IS TO BE DONE
 1001          80 IF(IPROMT.EQ.2)WRITE(IOUASK,290)
 1002         290 FORMAT('-','ENTER YEAR FOR THIS RUN -- (FORMAT = I4)')
 1003             READ(IOUGEN,300,END=99)IYEAR
 1004         300 FORMAT(I4)
 1005             IF(IYEAR.LT.1980)CALL QUITER(0.,IYEAR,36,INERR)
 1006             CALL TWFCAL(IYEAR)
 1007       C READ VEHICLE SPEED
 1008             IF(IPROMT.EQ.2)WRITE(IOUASK,310)
 1009         310 FORMAT('ENTER VEHICLE SPEED -- (FORMAT = F4.1)')
 1010             READ(IOUGEN,320,END=99)VEHSPD
 1011         320 FORMAT(F4.1)
 1012             IF(VEHSPD.LT.0.0)CALL QUITER(VEHSPD,0,19,INERR)
 1013             IF(VEHSPD.LT.0.0)VEHSPD=-1.*VEHSPD
 1014             IF(VEHSPD.LT.5.0)CALL QUITER(VEHSPD,0,21,INERR)
 1015             IF(VEHSPD.LT.5.0) VEHSPD=5.0
 1016             IF(VEHSPD.GT.55.0)CALL QUITER(VEHSPD,0,9,INERR)
 1017             IF(VEHSPD.GT.55.0) VEHSPD=55.0
 1018             IF(VEHSPD.GT.34.8)CALL QUITER(VEHSPD,0,34,INERR)
 1019             IF(VEHSPD.LT.19.6)CALL QUITER(VEHSPD,0,33,INERR)
 1020       C READ DRIVING CONDITIONS
 1021          90 IF(IPROMT.EQ.2)WRITE(IOUASK,330)
 1022         330 FORMAT(' ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)')
 1023             READ(IOUGEN,340,END=99)IDRIV
 1024         340 FORMAT(I1)
 1025             IF(IDRIV.LE.0.OR.IDRIV.GT.2) CALL QUITER(0.,IDRIV,35,INERR)
 1026       C READ PARTICLE SIZE CUTOFF
 1027         100 IF(IPROMT.EQ.2)WRITE(IOUASK,350)
 1028         350 FORMAT(' ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)')
 1029             READ(IOUGEN,360,END=99)PSZCUT
 1030         360 FORMAT(F5.2)
 1031             IF(PSZCUT.LT.0.1)CALL QUITER(PSZCUT,0,26,INERR)
 1032             IF(PSZCUT.LT.0.1)PSZCUT=0.1
 1033             IF(PSZCUT.GT.10.)CALL QUITER(PSZCUT,0,27,INERR)
 1034             IF(PSZCUT.GT.10.)PSZCUT=10.
 1035             CALL PARSIZ
 1036             IF(VMFLAG.NE.2) GOTO 95
 1037             IF(IPROMT.EQ.2)WRITE(IOUASK,272)
 1038         272 FORMAT(' ENTER VMT FRACTIONS FOR LDV, LDT1, LDT2, HDGV, HDDT, MC
 1039            C -6(F5.3,1X)')
 1040             CALL GETVMT(INERR,&99)
 1041          95 RETURN
 1042          99 CALL QUITER(0.,0,23,INERR)
 1043             RETURN
 1044             END
```

```
      C
      C
            SUBROUTINE PARSIZ
      C INTERPOLATES PARTICLE SIZE DISTRIBUTION
      C
            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
            COMMON/PSTEMP/PSDIST(5,2,6)
      C
            DO 60 ISRC=1,6
            PS=0.0
            MXSIZE=5
            IF(PSZCUT.LE.PSDIST(1,1,ISRC))GOTO 40
            DO 10 I=1,5
         10 IF(PSDIST(I,1,ISRC).EQ.0.0)MXSIZE=I
            IF(MXSIZE.EQ.1)PS=PSDIST(1,2,ISRC)
            IF(PSZCUT.GE.PSDIST(MXSIZE,1,ISRC))PS=PSDIST(MXSIZE,2,ISRC)
            IF(PS.NE.0.0)GOTO 50
            SLOPE=0.0
            NPTR=1
            DO 20 I=2,MXSIZE
         20 IF(PSDIST(I,1,ISRC).GE.PSZCUT.AND.NPTR.EQ.1)NPTR=I
            SLOPE=(PSDIST(NPTR,2,ISRC)-PSDIST(NPTR-1,2,ISRC))/
           &(PSDIST(NPTR,1,ISRC)-PSDIST(NPTR-1,1,ISRC))
            PS=SLOPE*(PSZCUT-PSDIST(NPTR-1,1,ISRC))+PSDIST(NPTR-1,2,ISRC)
            GOTO 50
         40 SLOPE=(PSDIST(2,2,ISRC)-PSDIST(1,2,ISRC))/
           &(PSDIST(2,1,ISRC)-PSDIST(1,1,ISRC))
            PS=PSDIST(1,2,ISRC)-SLOPE*(PSDIST(1,1,ISRC)-PSZCUT)
         50 IF(ISRC.EQ.1)PSL=PS
            IF(ISRC.EQ.2)PSNLCT=PS
            IF(ISRC.EQ.3)PSNL=PS
            IF(ISRC.EQ.4)PSDIE=PS
            IF(ISRC.EQ.5)PSBRK=PS
            IF(ISRC.EQ.6)PSTIRE=PS
         60 CONTINUE
            RETURN
            END
      C
            SUBROUTINE GETLCG(INERR,*)
      C CHANGE LEAD CONTENT OF GASOLINE
            COMMON/GAS/LCGSIZ,LCGVR(20),PBCG(20,2),NCFEVR(27),CFE(27,6),
           &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
            IF(IPROMT.EQ.2)WRITE(IOUASK,190)
        190 FORMAT('0','ALTERNATE LEAD CONTENT OF GASOLINE BY YEAR')
            IF(IPROMT.EQ.2)WRITE(IOUASK,195)
        195 FORMAT(' ENTER FIRST AND LAST YEAR TO CHANGE - (I4,1X,I4)')
          5 READ(IOUGEN,196,END=99)ISTART,IFIN
        196 FORMAT(I4,1X,I4)
            IF(ISTART.LT.1974.OR.ISTART.GT.IFIN)CALL QUITER(0.,0,16,INERR)
            IPTR=1
            DO 6 I=1,LCGSIZ
          6 IF(LCGVR(I).LT.ISTART)IPTR=I
            LCGSIZ=IPTR
            IF(IPROMT.EQ.2)WRITE(IOUASK,200)
        200 FORMAT('0','ENTER LEAD CONTENT OF GASOLINE FOR  LEADED
           & AND UNLEADED -- FORMAT=F5.3,1X,F5.3')
```

```
1103            DO 20 IVR=ISTART,IFIN
1104           10 IF(IPROMT.EQ.2)WRITE(IOUASK,210)IVR
1105          210 FORMAT(' FOR YEAR ',I5)
1106            LCGSIZ=LCGSIZ+1
1107            LCGYR(LCGSIZ)=IVR
1108            READ(IOUGEN,220,END=99)(PBCG(LCGSIZ,IFT),IFT=1,2)
1109          220 FORMAT(F5.3,1X,F5.3)
1110            IF(PBCG(LCGSIZ,1).LT.0.0)CALL QUITER(PBCG(LCGSIZ,1),IVR,28,INERR)
1111            IF(PBCG(LCGSIZ,1).LT.0.0)PBCG(LCGSIZ,1)=-1.*PBCG(LCGSIZ,1)
1112            IF(PBCG(LCGSIZ,2).LT.0.0)CALL QUITER(PBCG(LCGSIZ,2),IVR,29,INERR)
1113            IF(PBCG(LCGSIZ,2).LT.0.0)PBCG(LCGSIZ,2)=-1.*PBCG(LCGSIZ,2)
1114           20 CONTINUE
1115            RETURN
1116           99 RETURN1
1117            END
1118      C
1119            SUBROUTINE GETVMT(INERR,*)
1120      C
1121      C  GETVMT gets the fleet vehicle miles travelled (vmt) mix by vehicle type.
1122      C
1123      C  Called by ONESEC and PARSEC.
1124      C
1125      C  Calls QUITER.
1126      C
1127      C  Input on call:
1128      C
1129      C    parameter list: INERR
1130      C    common blocks:
1131      C    /FLAGS1/ IPROMT
1132      C    /IOUCOM/ IOUGEN,IOUASK
1133      C
1134      C  Output on return:
1135      C
1136      C
1137      C  Local variable / array dictionary:
1138      C
1139      C   Name   Type              Description
1140      C   ------  ----  ------------------------------------------------------
1141      C  VMTCHK    R    vmt mix check: sum of the vmt fractions = 1.0 +/- 1.E-6
1142      C                 (i.e., a normalized vmt distribution has been entered)
1143      C
1144      C  Notes:
1145      C
1146      C  GETVMT is a new subprogram (added for MOBILE3).
1147      C
1148      C
1149            INTEGER TAMFLG,SPCFLG,VMFLAG
1150      C
1151            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
1152            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
1153            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
1154      C
1155            IF(IPROMT.EQ.2) WRITE(IOUASK,200)
1156          200 FORMAT('0','Enter VMT split:')
1157            READ(IOUGEN,100,END=99) VMT
1158          100 FORMAT(6(F5.3,1X))
1159      C
1160            VMTCHK=0.0
```

```
      DO 10 IV=1,6
      VMTCHK=VMT(IV)+VMTCHK
      IF(VMT(IV).LT.0.0.OR.VMT(IV).GT.1.)
     *      CALL QUITER(VMT(IV),0,10,INERR)
   10 CONTINUE
      IF(VMTCHK+1.E-6.LT.1..OR.VMTCHK-1.E-6.GT.1.)
     *  CALL QUITER(VMTCHK,0,11,INERR)
C
      RETURN
C
C  EOF on any attempted read => take alternate return 1 => run aborts.
C
   99 RETURN1
      END
C
C*********************************************************************
C*                                                                   *
C* LEAD EMISSION FACTOR SUBROUTINES                                  *
C*                                                                   *
C*********************************************************************
      SUBROUTINE LEAD(IYEAR,IYRPTR,IVHCLS,IFT,VEHSPD,IDRIV,EF)
C CALCULATES LEAD EMISSION FACTOR FOR GIVEN VEHICLE.CLASS, YEAR,
C FUEL TYPE AND VEHICLE SPEED
C
      COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      COMMON/CONST/FPB,FPBE,FPBL
C
      EF=0.0
      PBRAT=1.557
      IF(IFT.GT.2)GOTO 99
      AS=FPB
      AMIS=FPBE
      IF(IYRPTR.GE.1981)AMIS=FPBL
      CALL GTPBCG(IYEAR,1,PBL)
      CALL GTPBCG(IYEAR,2,PBNL)
      CALL GETCS(IVHCLS,VEHSPD,IDRIV,CS)
      CALL GETCFE(IYRPTR,IVHCLS,FLECON)
      IF (IVHCLS.GT.3)GOTO 20
C LEADED LDV, LDT1, LDT2
      IF(IFT.EQ.2)GOTO  10
      CALL GETPB(IYRPTR,IVHCLS,1,EFPB1)
      CALL GETPB(IYRPTR,IVHCLS,2,EFPB2)
      EF=(PBL*EFPB1*PSL+PBNL*EFPB2*PSNL)*AS*PBRAT/(FLECON*CS)
      GOTO 99
C UNLEADED LDV, LDT1, LDT2
   10 IF(IYRPTR.LT.1975)GOTO 99
      CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
      FNOCAT=FREMCT(IYRPTR,IVHCLS,2,1)
      FCAT=FREMCT(IYRPTR,IVHCLS,2,6)
      EF=PBNL*(1.-RMIS)*PSNLCT*AS+(PBL*RMIS*PSL*AS)*(FNOCAT+TAMFRC*FCAT)
     &+PBL*RMIS*PSL*(1.-TAMFRC)*FCAT*AMIS
      EF=EF*PBRAT/(FLECON*CS)
      GOTO 99
C HDGV
   20 IF(IVHCLS.GT.5)GOTO 40
      IF(IFT.EQ.2)GOTO 30
C LEADED HDGV
      EF=AS*PBL*PBRAT*PSL/FLECON
```

```
      GOTO 99
C UNLEADED HDGV 1987+
   30 IF(IVRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
      CALL NLCONS(IYEAR,IVRPTR,VEHSPD,TAMFRC,RMIS)
      EF=((1.-RMIS)*AS*PBNL*PBRAT*PSNLCT/FLECON)+(RMIS*AMIS*PBL*
     &PBRAT*PSL/FLECON)
      GOTO 99
C MOTORCYCLES
   40 CALL GETPB(IVRPTR,IVHCLS,1,EFL)
      EF=EFL*PSL
   99 RETURN
      END
C
C
      SUBROUTINE GTPBCG(IVRPTR,IFT,PBCON)
C GET LEAD CONTENT OF LEADED AND UNLEADED GASOLINE
C
      COMMON/GAS/LCGSIZ,LCGVR(20),PBCG(20,2),NCFEVR(27),CFE(27,6),
     &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
C
      PBCON=0.0
      NPTR=1
      DO 10 I=1,LCGSIZ
   10 IF(IVRPTR.GE.LCGVR(I))NPTR=I
      PBCON=PBCG(NPTR,IFT)
      RETURN
      END
C
C
      SUBROUTINE GETPB(IVRPTR,IVHCLS,IFT,EFPB)
C FIND LEADED EMISSION FACTORS
C
      COMMON/EMPB/EFLEAD(20),IPBVR(20),IPBVH(20),IPBFT(20),NPBTOT
C
      EFPB=0.0
      IVH=IVHCLS
      IF(IVHCLS.EQ.2)IVH=1
      DO 10 I=1,NPBTOT
      IF(IVH.NE.IPBVH(I))GOTO 10
      IF(IFT.NE.IPBFT(I))GOTO 10
      IF(IVRPTR.GE.IPBVR(I))EFPB=EFLEAD(I)
   10 CONTINUE
   30 RETURN
      END
C
C
      SUBROUTINE GETCS(IVHCLS,VEHSPD,IDRIV,CS)
C GET SPEED DEPENDENT CORRECTION FACTOR
      COMMON/GAS/LCGSIZ,LCGVR(20),PBCG(20,2),NCFEVR(27),CFE(27,6),
     &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
C
      CS=0.0
      IF(IVHCLS.GT.3)GOTO  30
      IF(VEHSPD.LE.FECVS(1))CS=FEC(1,IDRIV)
      IF(VEHSPD.GE.FECVS(IFECSZ))CS=FEC(IFECSZ,IDRIV)
      IF(CS.NE.0)GOTO  30
      NPTR=1
      DO 10 I=2,IFECSZ
```

```
      10 IF(FECVS(I).GE.VEHSPD.AND.NPTR.EQ.1)NPTR=I
         SLOPE=(FEC(NPTR,IDRIV)-FEC(NPTR-1,IDRIV))/
        &(FECVS(NPTR)-FECVS(NPTR-1))
         CS=FEC(NPTR-1,IDRIV)+SLOPE*(VEHSPD-FECVS(NPTR-1))
      30 RETURN
         END
C
C
         SUBROUTINE GETCFE(IYRPTR,IVHCLS,FLECON)
C GET COMBINED CITY/HIGHWAY FUEL ECONOMY
C
         COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
        &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
C
         FLECON=0.0
         NPTR=1
         IVH=IVHCLS
         IF(IVHCLS.EQ.5.AND.IYRPTR.LT.1987)IVH=4
         IF(IVHCLS.EQ.6)GOTO  40
         DO 10 I=1,ICFESZ
      10 IF(IYRPTR.GE.NCFEYR(I))NPTR=I
         FLECON=CFE(NPTR,IVH)
      40 RETURN
         END
C
C
C
         SUBROUTINE NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
C UNLEADED EMISSIONS FACTORS CONSTANTS
C
         INTEGER TAMFLG,SPCFLG,VMFLAG
         COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
         COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
         COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
        &IEMCT,TAMPER(3,2)
C
         TAMFRC=0.0
         RMIS=0.0
         IAGE=IYEAR-IYRPTR
         IF(IYRPTR.LT.1975)GOTO 20
C UNLEADED LDV, LDT1,LDT2, HDGV
         IF(IVHCLS.LE.3)TAMFRC=TAMPER(IVHCLS,IMFLAG)
      10 IF(IVHCLS.GT.4)RMIS=0.0
         IF(IVHCLS.LE.4)RMIS=RMISFL(IAGE,IVHCLS,IMFLAG)
         IF(MISFLG.EQ.3.AND.IVHCLS.LE.3)RMIS=TMISFL(IVHCLS,IMFLAG)
         IF(IVHCLS.EQ.4.AND.IYRPTR.LT.1987)RMIS=0.0
         IF(RMIS.LT.0.0)RMIS=0.0
      20 RETURN
         END
C ******************************************************
C *                                                    *
C * ORGANIC EMISSION FACTORS SUBROUTINES               *
C *                                                    *
C ******************************************************
C
C
         SUBROUTINE ORGANC(IYEAR,IYRPTR,IVHCLS,IFT,EFORG)
C FIND ORGANIC EMISSIONS FACTORS
```

```
      C
            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      C
            EFORG=0.0
            IF(IFT.GT.2)GOTO  99
            IF(IVHCLS.GT.3)GOTO 20
            IF(IFT.EQ.2)GOTO 10
      C LEADED LDV, LDT1, LDT2
            CALL GETEFO(IVRPTR,IVHCLS,1,1,EF)
            EFORG=EF*PSL
            GOTO 99
      C UNLEADED LDV, LDT1, LDT2
         10 IF(IVRPTR.LT.1975)GOTO 99
            CALL NLCONS(IYEAR,IVRPTR,IVHCLS,TAMFRC,RMIS)
            FCAT=FREMCT(IVRPTR,IVHCLS,2,6)
            FNOCAT=FREMCT(IVRPTR,IVHCLS,2,1)
            CALL GETEFO(IVRPTR,IVHCLS,6,2,EFNLCT)
            CALL GETEFO(IVRPTR,IVHCLS,6,1,EFLCAT)
            CALL GETEFO(IVRPTR,IVHCLS,1,2,EFNL)
            EFORG=(1.-RMIS)*FCAT*EFNLCT*PSNLCT+RMIS*FCAT*EFLCAT*PSL+
           &FNOCAT*EFNL*PSNL
            GOTO 99
      C HDGV
         20 IF(IVHCLS.GT.5)GOTO  99
            CALL GETCFE(IVRPTR,IVHCLS,FLECON)
            IF(IVHCLS.EQ.4.AND.IVRPTR.GE.1987.AND.IFT.EQ.2)GOTO 30
            IF(IVHCLS.EQ.4.AND.IVRPTR.GE.1987.AND.IFT.NE.2)GOTO 99
            IF(IVHCLS.EQ.5.AND.IVRPTR.LT.1987)GOTO 99
            IF(IVHCLS.EQ.4.AND.IVRPTR.GE.1987.AND.IFT.NE.2)GOTO 99
      C ALL LEADED HDGV
            CALL GETEFO(IVRPTR,IVHCLS,1,1,EFL)
            EFORG=EFL*PSL*5.0/FLECON
            GOTO 99
      C UNLEADED HDGV 1987+
         30 IF(IVRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
            CALL NLCONS(IYEAR,IVRPTR,IVHCLS,TAMFRC,RMIS)
            CALL GETEFO(IVRPTR,IVHCLS,8,2,EFNLCT)
            CALL GETEFO(IVRPTR,IVHCLS,8,1,EFLCAT)
            EFORG=((1.-RMIS)*EFNLCT*PSNLCT+RMIS*EFLCAT*PSL)*5.0/FLECON
         99 RETURN
            END
      C
      C
            SUBROUTINE GETEFO(IVRPTR,IVHCLS,ICAT,IFT,EF)
      C GET ORGANIC EMISSION FACTOR
      C
            COMMON/EMORG/IORGYR(20),IORGFT(20),IORGCT(20),IORGVH(20),
           &EFO(20),NORTOT
      C
            EF=0.0
            IVH=IVHCLS
            IF(IFT.GT.2)GOTO 10
            IF(IVHCLS.EQ.5)IVH=4
            IF(IVHCLS.LE.3)IVH=1
            DO 10 I=1,NORTOT
            IF(IVH.NE.IORGVH(I))GOTO 10
            IF(ICAT.NE.IORGCT(I))GOTO 10
            IF(IFT.NE.IORGFT(I))GOTO 10
```

```
      IF(IVRPTR.GE.IORGVR(I))EF=EFO(I)
   10 CONTINUE
      RETURN
      END
C
C
C ************************************************************
C*                                                           *
C * SULFATE EMISSION FACTORS SUBROUTINES                      *
C *                                                           *
C ************************************************************
C
      SUBROUTINE SULFAT(IYEAR,IVRPTR,IVHCLS,VEHSPD,IFT,EF)
C FIND SULFATE EMISSIONS BY YEAR, VEHICLE.CLASS, AND FUEL TYPE
C
      COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
     &IEMCT,TAMPER(3,2)
      COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      EF=0.0
      IF(IFT.GT.2)GOTO  99
      IF(IVHCLS.GT.3)GOTO  20
      IF(IFT.EQ.2)GOTO  10
C LEADED NOCAT LDV, LDT1, LDT2
      CALL GETEFS(IVRPTR,IVHCLS,1,1,VEHSPD,EF)
      EF=EF*PSL
      GOTO 99
C UNLEADED 1975+ LDV, LDT1, LDT2
   10 IF(IVRPTR.LT.1975)GOTO 99
      CALL GETEFS(IVRPTR,IVHCLS,7,2,19.6,EFNOAR)
      CALL GETEFS(IVRPTR,IVHCLS,8,2,19.6,EFAIR)
      CALL GETEFS(IVRPTR,IVHCLS,1,2,19.6,EFNOCT)
      CALL GETEFS(IVRPTR,IVHCLS,6,1,19.6,EFMIS)
      CALL NLCONS(IYEAR,IVRPTR,IVHCLS,TAMFRC,RMIS)
      FNOAR=FREMCT(IVRPTR,IVHCLS,IFT,7)
      FAIR=FREMCT(IVRPTR,IVHCLS,IFT,8)
      FNOCAT=FREMCT(IVRPTR,IVHCLS,IFT,1)
      EFLO=(1.-RMIS)*(FNOAR*EFNOAR*PSNLCT+FAIR*EFAIR*PSNLCT+
     &FNOCAT*EFNOCT*PSNL)+RMIS*EFMIS*PSL
C
      CALL GETEFS(IVRPTR,IVHCLS,1,2,34.8,EFNOCT)
      CALL GETEFS(IVRPTR,IVHCLS,2,2,34.8,EFOX)
      CALL GETEFS(IVRPTR,IVHCLS,4,2,34.8,EF3W)
      CALL GETEFS(IVRPTR,IVHCLS,3,2,34.8,EFOXAR)
      CALL GETEFS(IVRPTR,IVHCLS,5,2,34.8,EF3WOX)
      CALL GETEFS(IVRPTR,IVHCLS,6,1,34.8,EFMIS)
C
      FOX=FREMCT(IVRPTR,IVHCLS,IFT,2)
      FOXAR=FREMCT(IVRPTR,IVHCLS,IFT,3)
      F3W=FREMCT(IVRPTR,IVHCLS,IFT,4)
      F3WOX=FREMCT(IVRPTR,IVHCLS,IFT,5)
C
      EFHI=(1.-RMIS)*(FNOCAT*EFNOCT*PSNL+FOX*EFOX*PSNLCT+
     &F3W*EF3W*PSNLCT+FOXAR*EFOXAR*PSNLCT+F3WOX*EF3WOX*PSNLCT)+
     &RMIS*EFMIS*PSL
      SLOPE=(EFHI-EFLO)/(34.8-19.6)
      EF=SLOPE*(VEHSPD-19.6)+EFLO
      GOTO 99
C HDGV
```

```
      20 IF(IVHCLS.GT.5)GOTO  40
         CALL GETCFE(IYRPTR,IVHCLS,FLECON)
         CALL GETEFS(IYRPTR,IVHCLS,1,1,VEHSPD,EFNOCT)
         IF(IFT.EQ.2)GOTO 30
         EF=EFNOCT*PSL*5.0/FLECON
         GOTO 99
C UNLEADED HDGV 1987+
      30 IF(IYRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
         CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
         CALL GETEFS(IYRPTR,IVHCLS,8,2,VEHSPD,EFCAT)
         EF=((1.-RMIS)*EFCAT*PSNLCT+RMIS*EFNOCT*PSL)*5.0/FLECON
         GOTO 99
C MOTORCYLES
      40 EF=0.0
      99 RETURN
         END
C
C
         SUBROUTINE GETEFS(IYRPTR,IVHCLS,ICAT,IFT,VEHSPD,EF)
C GETS SULFATE EMISSION FACTOR
C
         COMMON/EMSUL/ISULYR(20),ISULFT(20),ISULCT(20),ISULVH(20),
        &EFS(20,2),NSUTOT
C
         EF=0.0
         EF1=0.0
         EF2=0.0
         IVH=IVHCLS
         IF(IFT.GT.2)GOTO 99
         IF(IVHCLS.GE.6)GOTO 99
          IF(IVHCLS.LE.3)IVH=1
          IF(IVHCLS.EQ.5)IVH=4
         DO 10 I=1,NSUTOT
          IF(IVH.NE.ISULVH(I))GOTO 10
          IF(IFT.NE.ISULFT(I))GOTO10
          IF(ICAT.NE.ISULCT(I))GOTO 10
         IF(IVH.EQ.4.AND.IYRPTR.GE.ISULYR(I))EF=EFS(I,1)
         IF(EF.NE.0.0)GOTO 99
          IF(IYRPTR.GE.ISULYR(I).AND.EFS(I,2).LT.20.)EF1=EFS(I,1)
          IF(IYRPTR.GE.ISULYR(I).AND.EFS(I,2).GT.20.)EF2=EFS(I,1)
      10 CONTINUE
      20 IF(EF1.EQ.0.0.AND.EF2.EQ.0.0)GOTO 99
         SLOPE=(EF2-EF1)/(34.8-19.6)
         EF=EF1+SLOPE*(VEHSPD-19.6)
      99 RETURN
         END
C
         SUBROUTINE DIESEL(IYRPTR,IVHCLS,EF)
         COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
         COMMON/EMDIE/IDIEVR(20),IDIEVH(20),EFDP(20),NDITOT
         COMMON/HDDV/IHDDMY(13),HDDVCF(13)
         EF=0.0
         IVEH=IVHCLS
         IF(IVHCLS.EQ.3)IVEH=2
         IF(IVHCLS.GE.5)GOTO 99
         DO 10 I=1,NDITOT
         IF(IVEH.NE.IDIEVH(I))GOTO 10
         IF(IYRPTR.GE.IDIEVR(I))EF=EFDP(I)
```

```
      10 CONTINUE
         IF(IVHCLS.EQ.4)GOTO 20
         EF=EF*PSDIE
         GOTO 99
C HDDT
      20 DO 30 I=1,13
      30 IF(IYRPTR.GE.IHDDMY(I))CF=HDDVCF(I)
         EF=EF*PSDIE*CF
      99 RETURN
         END
C ********************************************************
C * FUNCTIONS                                            *
C ********************************************************
C
      FUNCTION FREMCT(IVRPTR,IVHCLS,IFT,ICAT)
      COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
     &IEMCT,TAMPER(3,2)
      IF(IVHCLS.LT.1.OR.IVHCLS.GT.6)CALL QUITER(0.,1,32,INERR)
      IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,1,32,INERR)
      IF(ICAT.LT.1.OR.ICAT.GT.8)CALL QUITER(0.,1,32,INERR)
      FREMCT=0.0
      NPTR=1
      DO 10 I=1,IEMCT
   10 IF(IYRPTR.GE.IEMCYR(I))NPTR=I
      IF(IFT.EQ.1)FREMCT=FPBEMC(NPTR,IVHCLS)
      IF(IFT.EQ.2)FREMCT=FNLEMC(NPTR,IVHCLS,ICAT)
      IF(IFT.EQ.3)FREMCT=FDIEMC(NPTR,IVHCLS)
      RETURN
      END
C
C
      FUNCTION FRFLT(IVRPTR,IVHCLS,IFT)
      COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
      IF(IVHCLS.LT.1.OR.IVHCLS.GT.6)CALL QUITER(0.,2,32,INERR)
      IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,2,32,INERR)
      FRFLT=0.0
      NPTR=1
      NFSF=IFSF(IVHCLS)
      DO 10 I=1,NFSF
   10 IF(IVRPTR.GE.IFSFYR(I,IVHCLS))NPTR=I
      FRFLT=FSF(NPTR,IVHCLS,IFT)
      RETURN
      END
C
C
C
C ********************************************************
C * CALCULATIONS                                         *
C ********************************************************
C
      SUBROUTINE CALC
C
      COMMON/TWFRAC/TWFAC(20,6,3)
      COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
      COMMON/ANSWER/PBSUM(6),ORGSUM(6),SULSUM(6),DIESUM(6),CLSSUM(6),
     &BRKSUM,TIRSUM,SUMALL
      COMMON/SCENR/IYEAR,VEHSPD,IDRIV
```

```
      C
      C START VEHICLE CLASS LOOP
            DO 10 IVHCLS=1,6
         10 CLSSUM(IVHCLS)=0.0
            DO 30 IVHCLS=1,6
            PBSUM(IVHCLS)=0.0
            ORGSUM(IVHCLS)=0.0
            SULSUM(IVHCLS)=0.0
            DIESUM(IVHCLS)=0.0
      C START 20-YEAR LOOP
            IFIRYR=IYEAR-19
            DO 20 IVRPTR=IFIRYR,IYEAR
            IAGE=IYEAR-IVRPTR+1
            IF(IAGE.GT.20)IAGE=20
      C FUEL TYPE LOOP (LEADED, UNLEADED)
            DO 15 IFT=1,2
            FR=FRFLT(IVRPTR,IVHCLS,IFT)
            TW=TWFAC(IAGE,IVHCLS,IFT)
            IF(IVRPTR.LT.1987.AND.IVHCLS.EQ.5)GOTO 15
            IF(IVRPTR.GE.1987.AND.IVHCLS.EQ.5.AND.IFT.EQ.2)GOTO 15
            IF(IVRPTR.GE.1987.AND.IVHCLS.EQ.4.AND.IFT.EQ.1)GOTO 15
            IF(IVRPTR.GE.1987.AND.IVHCLS.EQ.5.AND.IFT.EQ.1)FR=FRFLT(IVRPTR,4,1)
            CALL LEAD(IYEAR,IVRPTR,IVHCLS,IFT,VEHSPD,IDRIV,EFPB)
            PBSUM(IVHCLS)=PBSUM(IVHCLS)+EFPB*FR*TW
            CALL ORGANC(IYEAR,IVRPTR,IVHCLS,IFT,EFORG)
            ORGSUM(IVHCLS)=ORGSUM(IVHCLS)+EFORG*FR*TW
            CALL SULFAT(IYEAR,IVRPTR,IVHCLS,VEHSPD,IFT,EFSUL)
            SULSUM(IVHCLS)=SULSUM(IVHCLS)+EFSUL*FR*TW
            FRTW=FR*TW
         15 CONTINUE
            IFT=3
            CALL DIESEL(IVRPTR,IVHCLS,EFDIE)
            FR=FRFLT(IVRPTR,IVHCLS,IFT)
            DIESUM(IVHCLS)=DIESUM(IVHCLS)+EFDIE*FRFLT(IVRPTR,IVHCLS,IFT)*
           CTWFAC(IAGE,IVHCLS,IFT)
         20 CONTINUE
      C WEIGHT BY AREA TRAVEL FRACTION
            IF(IVHCLS.LE.3)CLSSUM(IVHCLS)=(PBSUM(IVHCLS)+ORGSUM(IVHCLS)+
           &SULSUM(IVHCLS)+DIESUM(IVHCLS))*VMT(IVHCLS)
            IF(IVHCLS.EQ.4.OR.IVHCLS.EQ.5)CLSSUM(4)=CLSSUM(4)+(PBSUM(IVHCLS)
           &+ORGSUM(IVHCLS)+SULSUM(IVHCLS))*VMT(4)
            IF(IVHCLS.EQ.4)CLSSUM(5)=DIESUM(4)*VMT(5)
            IF(IVHCLS.EQ.6)CLSSUM(6)=PBSUM(6)*VMT(6)
         30 CONTINUE
      C SHIFT HDGV2 TO HDGV
            PBSUM(4)=PBSUM(4)+PBSUM(5)
            ORGSUM(4)=ORGSUM(4)+ORGSUM(5)
            SULSUM(4)=SULSUM(4)+SULSUM(5)
            PBSUM(5)=0.0
            ORGSUM(5)=0.0
            SULSUM(5)=0.0
      C SHIFT HDDT TO CLASS FIVE
            DIESUM(5)=DIESUM(4)
            DIESUM(4)=0.0
      C
      C FIND TOTAL EMISSIONS
      C
            SUMALL=0.0
```

```
      DO 40 I=1,6
      SUMALL=SUMALL+CLSSUM(I)
   40 CONTINUE
      BRKSUM=PSBRK*0.0128
      TIRSUM=PSTIRE*0.002
      SUMALL=SUMALL+BRKSUM+TIRSUM
      RETURN
      END
C
C ***************************************************
C * OUTPUT ROUTINES                                 *
C ***************************************************
C
      SUBROUTINE OUT
C
      INTEGER TAMFLG,SPCFLG,VMFLAG
      COMMON/PROJCM/PROJID(20)
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
      COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      COMMON/ANSWER/PBSUM(6),ORGSUM(6),SULSUM(6),DIESUM(6),CLSSUM(6),
     &BRKSUM,TIRSUM,SUMALL
      COMMON/FLEET/FSF(26,6,3),IFSFVR(26,6),IFSF(6),VMT(6)
      COMMON/SCENR/IYEAR,VEHSPD,IDRIV
C
      DIMENSION NAMTAM(2),NAMIM(2),NMYMR(4),NAMVM(3),NAMSPC(3),
     &NAMDRV(2),CLSNM(6),NAMMIS(3)
      DATA NAMTAM/'NORM','USER'/,
     &     NAMIM/' NO ',' YES'/,
     &     NMYMR/'NORM','MILE',' REG',' M+R'/,
     &     NAMVM/'NORM','SCEN','USER'/,
     &     NAMSPC/'NORM','USER'/,
     &     NAMDRV/'TRAN','CRSE'/,
     &     NAMMIS/'NORM','USER','SMPL'/,
     &     CLSNM/'LDV ','LDT1','LDT2','HDGV','HDDT',' MC '/
      CALL OUTHDR(IOUREP)
      WRITE(IOUREP,1030)IYEAR,VEHSPD,PSZCUT
 1030 FORMAT('0CALCULATIONS FOR YEAR ',I4,'  SPEED ',F5.1,' MPH',
     &'   PARTICLE CUTOFF =',F5.2,' MICRONS')
      WRITE(IOUREP,1000)NAMTAM(TAMFLG),NAMMIS(MISFLG),NAMVM(VMFLAG)
 1000 FORMAT('0FLAG SETTINGS: '/'  TAMPERING RATES    = ',A4,
     &'   MISFUELING RATES  = ',A4,'    VMT MIXTURE        = ',A4)
      WRITE(IOUREP,1010)NMYMR(MYMRFG),NAMIM(IMFLAG),NAMSPC(SPCFLG)
 1010 FORMAT('  MILEAGE & REGIST.  = ',A4,'   I/M PROGRAM       = ',
     &A4,'    SPECIAL CONDITIONS = ',A4)
      WRITE(IOUREP,1020)NAMDRV(IDRIV)
 1020 FORMAT('  DRIVING CONDITIONS = ',A4)
C PRINT BREAKDOWN
      WRITE(IOUREP,1025)
 1025 FORMAT('0',9X,'PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS')
      WRITE(IOUREP,1040)
 1040 FORMAT('0','VEH.CLASS',2X,' LEAD  ',2X,'ORGANIC',2X,'SULFATE',2X,
     &' DIESEL ',2X,'TOTAL',4X,'VMT FRAC.',2X,'VMT WT. TOTAL')
      DO 10 IVHCLS=1,6
      CLS=0.0
      IF(VMT(IVHCLS).NE.0.0)CLS=CLSSUM(IVHCLS)/VMT(IVHCLS)
   10 WRITE(IOUREP,1050)CLSNM(IVHCLS),PBSUM(IVHCLS),ORGSUM(IVHCLS),
     &SULSUM(IVHCLS),DIESUM(IVHCLS),CLS,VMT(IVHCLS),CLSSUM(IVHCLS)
```

```
1683       1050 FORMAT(3X,A4,3X,2X,4(F7.4,2X),F7.4,4X,F7.4,4X,F7.4)
1684            WRITE(IOUREP,1052)BRKSUM,TIRSUM
1685       1052 FORMAT(' TOTAL BRAKE PARTICULATES = ',F6.4/
1686           *' TOTAL TIRE PARTICULATES  = ',F6.4)
1687            WRITE(IOUREP,1055)SUMALL
1688       1055 FORMAT(' TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = ',F7.4)
1689      C OUTPUT FRACTIONS
1690            WRITE(IOUREP,1060)
1691       1060 FORMAT('0',18X,'PARTICULATE FRACTION BY VEHICLE CLASS')
1692            WRITE(IOUREP,1070)
1693       1070 FORMAT(1X,'VEH.CLASS',2X,' LEAD  ',2X,'ORGANIC',2X,'SULFATE',
1694           &2X,'DIESEL ')
1695            DO 20 IVHCLS=1,6
1696            PB=0.0
1697            ORG=0.0
1698            SUL=0.0
1699            DIE=0.0
1700            IF(CLSSUM(IVHCLS).EQ.0.0)GOTO 20
1701            PB=PBSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
1702            ORG=ORGSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
1703            SUL=SULSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
1704            DIE=DIESUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
1705         20 WRITE(IOUREP,1050)CLSNM(IVHCLS),PB,ORG,SUL,DIE
1706            RETURN
1707            END
1708            SUBROUTINE OUTHDR(IOUOUT)
1709      C
1710      C  OUTHDR writes the run title on unit IOUOUT.
1711      C
1712      C  CALLED BY CONSEC, OUT
1713      C
1714      C  Input on call:
1715      C
1716      C    parameter list: IOUOUT
1717      C    common block: /PROJCM/ PROJID
1718      C
1719      C  Output on return:
1720      C
1721      C    common block: /SYSCOM/ INITPR
1722      C
1723      C
1724            COMMON /PROJCM/ PROJID(20)
1725      C
1726            WRITE(IOUOUT,200) PROJID
1727        200 FORMAT('1',20A4)
1728      C
1729            RETURN
1730            END
1731      C
1732      C
1733            BLOCK DATA
1734            COMMON/EMORG/IORGVR(20),IORGFT(20),IORGCT(20),IORGVH(20),
1735           &EFO(20),NORTOT
1736            COMMON/EMSUL/ISULVR(20),ISULFT(20),ISULCT(20),ISULVH(20),
1737           &EFS(20,2),NSUTOT
1738            COMMON/EMDIE/IDIEVR(20),IDIEVH(20),EFDP(20),NDITOT
1739            COMMON/EMPB/EFLEAD(20),IPBVR(20),IPBVH(20),IPBFT(20),NPBTOT
1740            COMMON/GAS/LCGSIZ,LCGVR(20),PBCG(20,2),NCFEVR(27),CFE(27,6),
```

```
     &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
      COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
      COMMON/PSTEMP/PSDIST(5,2,6)
      COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
      COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDVR(21),HDDTRG(21,4)
      COMMON/HDDV/IHDDMY(13),HDDVCF(13)
      COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
     &IEMCT,TAMPER(3,2)
      COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
C
      DATA IORGYR/20*0/,
     &     IORGFT/20*0/,
     &     IORGCT/20*0/,
     &     IORGVH/20*0/,
     &     EFO/20*0.0/,
     &     NORTOT/0/
C
      DATA ISULYR/20*0/,
     &     ISULFT/20*0/,
     &     ISULCT/20*0/,
     &     ISULFT/20*0/,
     &     ISULVH/20*0/,
     &     EFS/40*0.0/,
     &     NSUTOT/0/
C
      DATA IDIEYR/20*0/,
     &     IDIEVH/20*0/,
     &     EFDP/20*0.0/,
     &     NDITOT/0/
C
      DATA EFLEAD/20*0.0/,
     &     IPBYR/20*0/,
     &     IPBVH/20*0/,
     &     IPBFT/20*0/,
     &     NPBTOT/0/
C
      DATA LCGSIZ/0/,
     &     LCGYR/20*0/,
     &     PBCG/40*0.0/,
     &     NCFEYR/27*0/,
     &     CFE/162*0.0/,
     &     ICFESZ/0/,
     &     FECVS/13*0.0/,
     &     FEC/13*0.0/
C
      DATA RMISFL/160*0.0/,
     &     TMISFL/12*0.0/
      DATA PSDIST/60*0.0/
C
      DATA TWFREG/360*0.0/,
     &     ITWFMA/360*0/
C
      DATA IHTRG/0/,
     &     IHDDMA/80*0/,
     &     IHDDVR/21*0/,
     &     HDDTRG/84*0.0/
C
      DATA IHDDMY/13*0/,
```

```
1799           &     HDDVCF/13*0.0/
1800     C
1801            DATA FPBEMC/90*0.0/,
1802           &     FNLEMC/720*0.0/,
1803           &     FDIEMC/90*0.0/,
1804           &     IEMCYR/15/,
1805           &     IEMCT/0/,
1806           &     TAMPER/6*0.0/
1807     C
1808            DATA FSF/468*0.0/,
1809           &     IFSFYR/156*0/,
1810           &     IFSF/6*0/,
1811           &     VMT/6*0.0/
1812     C
1813            END
```

APPENDIX B

PROGRAM DATA FILE

```
  1      6
  2     1900 0 1 1 0.193
  3     1970 0 1 1 0.068
  4     1975 0 1 1 0.030
  5     1975 0 6 2 0.017
  6     1975 0 6 1 0.068
  7     1975 0 1 2 0.030
  8     13
  9     1900 S 1 1 19.6 0.002
 10     1975 S 6 1 19.6 0.002
 11     1974 S 1 1 34.8 0.001
 12     1975 S 7 2 19.6 0.005
 13     1975 S 8 2 19.6 0.016
 14     1975 S 1 2 19.6 0.002
 15     1975 S 1 1 34.8 0.001
 16     1975 S 1 2 34.8 0.001
 17     1975 S 2 2 34.8 0.005
 18     1975 S 4 2 34.8 0.001
 19     1975 S 3 2 34.8 0.020
 20     1975 S 5 2 34.8 0.025
 21     1975 S 6 1 34.8 0.001
 22      3
 23     1900 0.700
 24     1981 0.300
 25     1987 0.200
 26      3
 27     1900 0.800
 28     1981 0.300
 29     1987 0.260
 30      4
 31     1900 0 1 1 0.370
 32     1987 0 8 2 0.054
 33     1987 0 8 1 0.163
 34     1987 0 1 1 0.370
 35      3
 36     1900 S 1 1 0.006
 37     1987 S 8 2 0.048
 38     1987 S 1 1 0.006
 39      1
 40     1900 0.700
 41      6
 42     1900 1 0.887
 43     1900 2 0.113
 44     1971 1 0.916
 45     1971 2 0.084
 46     1975 1 0.724
 47     1975 2 0.276
 48      6
 49     1900 1 0.887
 50     1900 2 0.113
 51     1971 1 0.916
 52     1971 2 0.084
 53     1979 1 0.724
 54     1979 2 0.276
 55      2
 56     1900 1 0.198
 57     1978 1 0.046
 58     17
```

```
 59      1900 1.79 0.014
 60      1975 1.82 0.014
 61      1976 2.02 0.014
 62      1977 2.03 0.014
 63      1978 1.94 0.014
 64      1979 1.85 0.014
 65      1980 1.38 0.014
 66      1981 1.15 0.014
 67      1982 1.24 0.014
 68      1983 1.14 0.014
 69      1984 1.10 0.014
 70      1985 1.10 0.014
 71      1986 1.10 0.014
 72      1987 1.10 0.014
 73      1988 1.10 0.014
 74      1989 1.10 0.014
 75      1990 1.10 0.014
 76      15
 77      1.000 0.128 0.134 0.158 0.126 0.097 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
 78      0.000 0.081 0.020 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
 79      0.000 0.597 0.637 0.650 0.650 0.640 0.421 0.033 0.000 0.000 0.000 0.000 0.000 0.000 0.000
 80      0.000 0.322 0.343 0.350 0.350 0.345 0.514 0.099 0.142 0.109 0.000 0.000 0.000 0.000 0.000
 81      0.000 0.000 0.000 0.000 0.000 0.015 0.053 0.263 0.313 0.244 0.396 0.532 0.587 0.641 0.704
 82      0.000 0.000 0.000 0.000 0.000 0.000 0.012 0.605 0.545 0.647 0.604 0.468 0.414 0.359 0.296
 83      0.000 0.003 0.003 0.004 0.009 0.028 0.034 0.061 0.046 0.053 0.060 0.066 0.073 0.080 0.090
 84      0.000 0.919 0.980 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
 85      0.000 0.597 0.637 0.650 0.650 0.655 0.474 0.296 0.149 0.194 0.237 0.381 0.450 0.518 0.554
 86      0.000 0.322 0.343 0.350 0.350 0.345 0.526 0.704 0.851 0.806 0.763 0.691 0.587 0.482 0.446
 87      22
 88      1900 0.000 1.000 0.000
 89      1975 0.869 0.128 0.003
 90      1976 0.863 0.134 0.003
 91      1977 0.838 0.158 0.004
 92      1978 0.865 0.126 0.009
 93      1979 0.875 0.097 0.028
 94      1980 0.966 0.000 0.034
 95      1981 0.939 0.000 0.061
 96      1982 0.954 0.000 0.046
 97      1983 0.947 0.000 0.053
 98      1984 0.940 0.000 0.060
 99      1985 0.934 0.000 0.066
100      1986 0.927 0.000 0.073
101      1987 0.920 0.000 0.080
102      1988 0.910 0.000 0.090
103      1989 0.900 0.000 0.100
104      1990 0.887 0.000 0.113
105      1991 0.887 0.000 0.113
106      1992 0.886 0.000 0.114
107      1993 0.886 0.000 0.114
108      1994 0.885 0.000 0.115
109      1995 0.885 0.000 0.115
110      01 0.028 12818 0358.9 0.038
111      02 0.107 12639 1352.4 0.142
112      03 0.100 11933 1193.3 0.125
113      04 0.094 11268 1059.2 0.111
114      05 0.088 10639 0936.2 0.098
115      06 0.080 10045 0803.6 0.084
116      07 0.075 09485 0711.4 0.075
```

```
117     08 0.069 08955 0617.9 0.065
118     09 0.062 08455 0524.2 0.055
119     10 0.056 07983 0447.0 0.047
120     11 0.050 07538 0376.9 0.040
121     12 0.043 07117 0306.0 0.032
122     13 0.037 06720 0248.6 0.026
123     14 0.031 06345 0196.7 0.021
124     15 0.024 05991 0143.8 0.015
125     16 0.018 05657 0101.8 0.011
126     17 0.012 05341 0064.1 0.007
127     18 0.008 04043 0032.3 0.003
128     19 0.006 04762 0028.6 0.003
129     20 0.008 04496 0036.0 0.004
130     27
131     1900 13.9 10.6 07.9 00.0 0.0 6.5
132     1970 13.9 10.6 07.9 00.0 0.0 6.4
133     1971 13.2 10.4 07.7 00.0 0.0 6.4
134     1972 13.1 10.2 07.4 00.0 0.0 6.4
135     1973 12.9 09.9 07.0 00.0 0.0 6.5
136     1974 12.6 09.6 06.9 00.0 0.0 6.7
137     1975 13.5 11.6 08.8 00.0 0.0 6.8
138     1976 14.8 12.3 09.7 00.0 0.0 7.3
139     1977 15.5 13.0 09.4 00.0 0.0 7.7
140     1978 16.8 13.4 09.6 00.0 0.0 8.0
141     1979 17.2 14.2 09.8 00.0 0.0 8.2
142     1980 20.0 16.1 11.5 00.0 0.0 8.4
143     1981 21.4 17.7 13.3 00.0 0.0 8.6
144     1982 22.2 18.6 13.6 00.0 0.0 8.8
145     1983 22.2 19.2 13.7 00.0 0.0 8.9
146     1984 22.8 19.9 13.9 00.0 0.0 8.9
147     1985 23.2 20.7 14.0 00.0 0.0 9.0
148     1986 23.8 21.4 14.3 00.0 0.0 9.0
149     1987 24.3 23.0 14.5 09.5 5.6 9.0
150     1988 24.8 23.3 14.7 09.5 5.6 9.1
151     1989 25.2 23.1 14.9 09.6 5.6 9.2
152     1990 25.7 24.0 15.2 09.7 5.6 9.2
153     1991 26.2 24.5 15.4 09.7 5.7 9.3
154     1992 26.6 24.4 15.7 09.8 5.7 9.4
155     1993 27.2 25.3 15.9 09.8 5.7 9.4
156     1994 27.6 25.8 16.2 09.9 5.7 9.5
157     1995 29.0 26.2 16.4 10.1 5.8 9.6
158     13
159     05.0 0.323 0.467
160     10.0 0.553 0.709
161     15.0 0.692 0.997
162     20.0 0.790 1.153
163     25.0 0.885 1.248
164     30.0 0.963 1.294
165     32.7 1.000 1.303
166     35.0 1.022 1.303
167     40.0 1.053 1.288
168     45.0 1.073 1.256
169     50.0 1.078 1.210
170     55.0 1.063 1.159
171     60.0 1.023 1.104
172     15
173     1.000 0.188 0.088 0.038 0.027 0.030 0.021 0.026 0.021 0.022 0.000 0.000 0.000 0.000 0.000
174     0.000 0.123 0.225 0.083 0.069 0.034 0.027 0.011 0.000 0.000 0.000 0.000 0.000 0.000 0.000
```

```
175     0.000 0.570 0.504 0.596 0.605 0.561 0.564 0.574 0.066 0.092 0.003 0.000 0.000 0.000 0.000
176     0.000 0.307 0.271 0.321 0.325 0.405 0.409 0.415 0.887 0.687 0.595 0.550 0.550 0.150 0.150
177     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.027 0.054 0.126 0.150 0.150 0.350 0.350
178     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.021 0.167 0.276 0.300 0.300 0.500 0.500
179     0.000 0.002 0.003 0.005 0.009 0.028 0.034 0.060 0.080 0.100 0.130 0.160 0.180 0.210 0.240
180     0.000 0.877 0.775 0.917 0.930 0.966 0.973 0.989 1.000 1.000 1.000 1.000 1.000 1.000 1.000
181     0.000 0.570 0.504 0.596 0.605 0.561 0.564 0.574 0.069 0.073 0.056 0.080 0.080 0.200 0.200
182     0.000 0.307 0.271 0.321 0.325 0.405 0.409 0.415 0.931 0.927 0.944 0.920 0.920 0.800 0.800
183     22
184     1900 0.000 1.000 0.000
185     1975 0.810 0.188 0.002
186     1976 0.909 0.088 0.003
187     1977 0.957 0.038 0.005
188     1978 0.964 0.027 0.009
189     1979 0.942 0.030 0.028
190     1980 0.945 0.021 0.034
191     1981 0.914 0.026 0.060
192     1982 0.899 0.021 0.080
193     1983 0.878 0.022 0.100
194     1984 0.870 0.000 0.130
195     1985 0.840 0.000 0.160
196     1986 0.820 0.000 0.180
197     1987 0.790 0.000 0.210
198     1988 0.760 0.000 0.240
199     1989 0.730 0.000 0.270
200     1990 0.706 0.000 0.294
201     1991 0.697 0.000 0.303
202     1992 0.688 0.000 0.312
203     1993 0.679 0.000 0.321
204     1994 0.670 0.000 0.330
205     1995 0.661 0.000 0.339
206     01 0.023 17394 0400.1 0.036
207     02 0.089 17079 1520.0 0.135
208     03 0.085 15839 1346.3 0.120
209     04 0.081 14690 1189.9 0.106
210     05 0.076 13624 1035.4 0.092
211     06 0.072 12636 0909.8 0.081
212     07 0.068 11719 0796.9 0.071
213     08 0.064 10868 0695.6 0.062
214     09 0.060 10080 0604.8 0.054
215     10 0.055 09348 0514.1 0.046
216     11 0.050 08670 0433.5 0.039
217     12 0.046 08041 0369.9 0.033
218     13 0.042 07457 0313.2 0.028
219     14 0.038 06916 0262.8 0.023
220     15 0.034 06415 0218.1 0.019
221     16 0.029 05949 0172.5 0.015
222     17 0.025 05517 0137.9 0.012
223     18 0.021 05117 0107.5 0.009
224     19 0.017 04746 0080.7 0.007
225     20 0.025 04402 0110.1 0.010
226     15
227     1.000 1.000 1.000 1.000 0.988 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
228     0.000 0.000 0.000 0.000 0.000 0.008 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
229     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.222 0.284 0.000 0.000 0.000 0.000 0.000
230     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.704 0.577 0.823 0.800 0.800 0.000 0.000
231     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.012 0.003 0.000 0.000 0.020 0.020
232     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.074 0.127 0.174 0.200 0.200 0.980 0.980
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233     0.000 0.000 0.000 0.000 0.012 0.025 0.050 0.050 0.080 0.113 0.147 0.180 0.194 0.208 0.222
234     0.000 0.000 0.000 0.000 0.000 0.992 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
235     0.000 0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.222 0.293 0.000 0.000 0.000 0.020 0.020
236     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.778 0.707 1.000 1.000 1.000 0.980 0.980
237     22
238     1900 0.000 1.000 0.000
239     1975 0.000 0.998 0.002
240     1976 0.000 0.997 0.003
241     1977 0.000 0.995 0.005
242     1978 0.000 0.991 0.009
243     1979 0.972 0.000 0.028
244     1980 0.966 0.000 0.034
245     1981 0.940 0.000 0.060
246     1982 0.920 0.000 0.080
247     1983 0.900 0.000 0.100
248     1984 0.870 0.000 0.130
249     1985 0.840 0.000 0.160
250     1986 0.820 0.000 0.180
251     1987 0.790 0.000 0.210
252     1988 0.760 0.000 0.240
253     1989 0.730 0.000 0.270
254     1990 0.706 0.000 0.294
255     1991 0.697 0.000 0.303
256     1992 0.688 0.000 0.312
257     1993 0.679 0.000 0.321
258     1994 0.670 0.000 0.330
259     1995 0.661 0.000 0.339
260     01 0.023 18352 0422.1 0.036
261     02 0.089 18001 1602.1 0.138
262     03 0.085 16622 1412.9 0.122
263     04 0.081 15348 1243.2 0.107
264     05 0.076 14172 1077.1 0.093
265     06 0.072 13087 0942.3 0.081
266     07 0.068 12084 0821.7 0.071
267     08 0.064 11158 0714.1 0.062
268     09 0.060 10303 0618.2 0.053
269     10 0.055 09514 0523.3 0.045
270     11 0.050 08785 0439.3 0.038
271     12 0.046 08112 0373.2 0.032
272     13 0.042 07491 0314.6 0.027
273     14 0.038 06917 0262.8 0.023
274     15 0.034 06386 0217.1 0.019
275     16 0.029 05897 0171.0 0.015
276     17 0.025 05446 0136.2 0.012
277     18 0.021 05028 0105.6 0.009
278     19 0.017 04643 0078.9 0.007
279     20 0.025 04287 0107.2 0.009
280     01 0.023 17552 0403.7 0.035
281     02 0.087 17230 1499.0 0.129
282     03 0.083 15964 1325.0 0.114
283     04 0.079 14791 1168.5 0.101
284     05 0.075 13705 1027.9 0.088
285     06 0.071 12699 0901.6 0.078
286     07 0.066 11766 0776.6 0.067
287     08 0.062 10901 0675.9 0.058
288     09 0.058 10101 0585.9 0.050
289     10 0.054 09359 0505.4 0.043
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 291      12 0.045 08035 0361.6 0.031
 292      13 0.041 07444 0305.2 0.026
 293      14 0.037 06897 0255.2 0.022
 294      15 0.033 06391 0210.9 0.018
 295      16 0.029 05921 0171.7 0.015
 296      17 0.025 05487 0137.2 0.012
 297      18 0.020 05084 0101.7 0.009
 298      19 0.018 04710 0075.4 0.006
 299      20 0.025 04364 0109.1 0.009
 300      20
 301      1900 0.000 1.000
 302      1977 0.000 1.000
 303      1978 0.000 1.000
 304      1979 0.000 1.000
 305      1980 0.000 1.000
 306      1981 0.000 1.000
 307      1982 0.000 1.000
 308      1983 0.000 1.000
 309      1984 0.000 1.000
 310      1985 0.000 1.000
 311      1986 0.000 1.000
 312      1987 0.823 0.177
 313      1988 0.824 0.176
 314      1989 0.825 0.175
 315      1990 0.826 0.174
 316      1991 0.828 0.172
 317      1992 0.829 0.171
 318      1993 0.833 0.167
 319      1994 0.837 0.163
 320      1995 0.840 0.160
 321      01 0.000 00000 0000.0 0.000
 322      02 0.148 19967 2955.1 0.227
 323      03 0.126 18077 2277.7 0.175
 324      04 0.107 16365 1751.1 0.134
 325      05 0.092 14815 1363.0 0.105
 326      06 0.078 13413 1046.2 0.080
 327      07 0.067 12143 0813.6 0.062
 328      08 0.058 10993 0637.6 0.049
 329      09 0.049 09952 0487.6 0.037
 330      10 0.041 09010 0369.4 0.028
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 332      12 0.030 07384 0221.5 0.017
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 334      14 0.022 06052 0133.1 0.010
 335      15 0.020 05479 0121.0 0.009
 336      16 0.016 04960 0079.4 0.006
 337      17 0.014 04490 0062.9 0.005
 338      18 0.012 04065 0048.8 0.004
 339      19 0.010 03680 0036.8 0.003
 340      20 0.049 03332 0163.3 0.013
 341      20
 342      01 0.000 00000 00000.0 0.000
 343      02 0.166 67910 11273.1 0.241
 344      03 0.138 61749 08521.4 0.182
 345      04 0.115 56155 06457.8 0.138
 346      05 0.097 51073 04954.1 0.106
 347      06 0.080 46457 03716.6 0.079
 348      07 0.067 42260 02831.4 0.060
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08 0.056 38447 02153.0 0.046
09 0.047 34982 01644.2 0.035
10 0.040 31832 01273.3 0.027
11 0.033 28968 00955.9 0.020
12 0.027 26363 00711.8 0.015
13 0.023 23995 00551.9 0.012
14 0.019 21843 00415.0 0.009
15 0.015 19883 00298.2 0.006
16 0.013 18101 00235.3 0.005
17 0.011 16481 00181.3 0.004
18 0.009 15007 00135.1 0.003
19 0.008 13665 00109.3 0.002
20 0.034 12444 00423.1 0.009
01 0.000 0000 000.0 0.000
02 0.167 4100 685.7 0.356
03 0.159 2800 445.7 0.232
04 0.134 2100 281.0 0.146
05 0.142 1600 227.0 0.118
06 0.131 1200 157.8 0.082
07 0.080 0800 063.7 0.033
08 0.051 0600 030.4 0.016
09 0.028 0400 011.1 0.001
10 0.010 0200 002.1 0.010
11 0.098 0200 019.6 0.000
12 0.000 0200 000.0 0.000
13 0.000 0000 000.0 0.000
14 0.000 0000 000.0 0.000
15 0.000 0000 000.0 0.000
16 0.000 0000 000.0 0.000
17 0.000 0000 000.0 0.000
18 0.000 0000 000.0 0.000
19 0.000 0000 000.0 0.000
20 0.000 0000 000.0 0.000
LDV  0.09 0.20
LDT1 0.20 0.46
LDT2 0.21 0.47
HDGV 0.19 0.40
MC   0.00 0.00
20
01 .04 .04 .22 .13 .23 .13 .18 .12
02 .07 .05 .27 .14 .27 .15 .23 .13
03 .10 .06 .31 .16 .32 .16 .28 .15
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05 .16 .08 .38 .18 .39 .18 .36 .17
06 .18 .09 .42 .19 .43 .19 .39 .18
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10 .27 .11 .52 .22 .54 .23 .50 .22
11 .29 .12 .55 .23 .56 .23 .52 .22
12 .31 .12 .57 .24 .58 .24 .54 .23
13 .33 .13 .59 .24 .60 .25 .56 .23
14 .34 .13 .60 .25 .62 .25 .57 .24
15 .36 .14 .62 .25 .63 .26 .59 .24
16 .37 .14 .64 .26 .65 .26 .60 .25
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19 .41 .15 .68 .27 .69 .27 .63 .25
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 408      0.20  2.00 10.00
 409      0.23  0.43  0.64
 410      0.20  2.00 10.00
 411      0.87  0.89  0.97
 412      0.20  2.00 10.00
 413      0.42  0.66  0.90
 414      0.20  1.00  2.00  2.50 10.00
 415      0.73  0.86  0.90  0.92  1.00
 416      0.43  1.10  4.70  7.00 10.00
 417      0.09  0.16  0.82  0.90  0.98
 418      0.10 10.00
 419      0.01  1.00
 420     13
 421     1951 2.7420
 422     1963 2.7307
 423     1966 2.8267
 424     1969 3.0080
 425     1972 3.1917
 426     1975 3.1420
 427     1980 2.7780
 428     1982 2.5580
 429     1985 2.4700
 430     1986 2.4260
 431     1987 2.3600
 432     1993 2.3175
 433     1997 2.2970
 434     0.75 0.40 0.44
 435     0.045 0.195 0.195
 436     0.017 0.050 0.050
 437     20
 438     01 18352 45544 53370 82288
 439     02 16946 39671 46901 74984
 440     03 15648 34558 41190 68328
 441     04 14449 30092 36206 62263
 442     05 13342 26213 31812 56737
 443     06 12320 22834 27948 51700
 444     07 11376 19898 24556 47111
 445     08 10504 17332 21575 42930
 446     09  9700 15098 18956 39119
 447     10  8956 13152 16655 35647
 448     11  8270 11456 14632 32483
 449     12  7637  9979 12856 29599
 450     13  7052  8693 11296 26972
 451     14  6511  7572  9925 24578
 452     15  6012  6596  8719 22396
 453     16  5552  5746  7661 20408
 454     17  5126  5005  6728 18597
 455     18  4734  4360  5913 16946
 456     19  4371  3798  5196 15442
 457     20  4036  3308  4565 14071
 458     21
 459     1980 0.000 0.006 0.112 1.521
 460     1981 0.000 0.006 0.124 1.581
 461     1982 0.049 0.009 0.135 1.599
 462     1983 0.104 0.013 0.141 1.592
 463     1984 0.185 0.022 0.153 1.641
 464     1985 0.274 0.037 0.166 1.719
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465     1986 0.370 0.053 0.177 1.816
466     1987 0.475 0.071 0.185 1.927
467     1988 0.588 0.089 0.193 2.041
468     1989 0.707 0.106 0.201 2.151
469     1990 0.831 0.122 0.208 2.258
470     1991 0.960 0.137 0.215 2.362
471     1992 1.092 0.151 0.222 2.471
472     1993 1.225 0.165 0.229 2.581
473     1994 1.354 0.178 0.237 2.693
474     1995 1.480 0.190 0.245 2.807
475     1996 1.600 0.202 0.253 2.914
476     1997 1.712 0.212 0.261 3.015
477     1998 1.816 0.222 0.269 3.108
478     1999 1.912 0.230 0.276 3.194
479     2000 1.999 0.238 0.283 3.273
480     0.7845 0.0827 0.0470 0.0419 0.0354 0.0085
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